Welding Engineer

DECEMBER, 1960

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In this issue: **Economic plasma cutting of mild steel**

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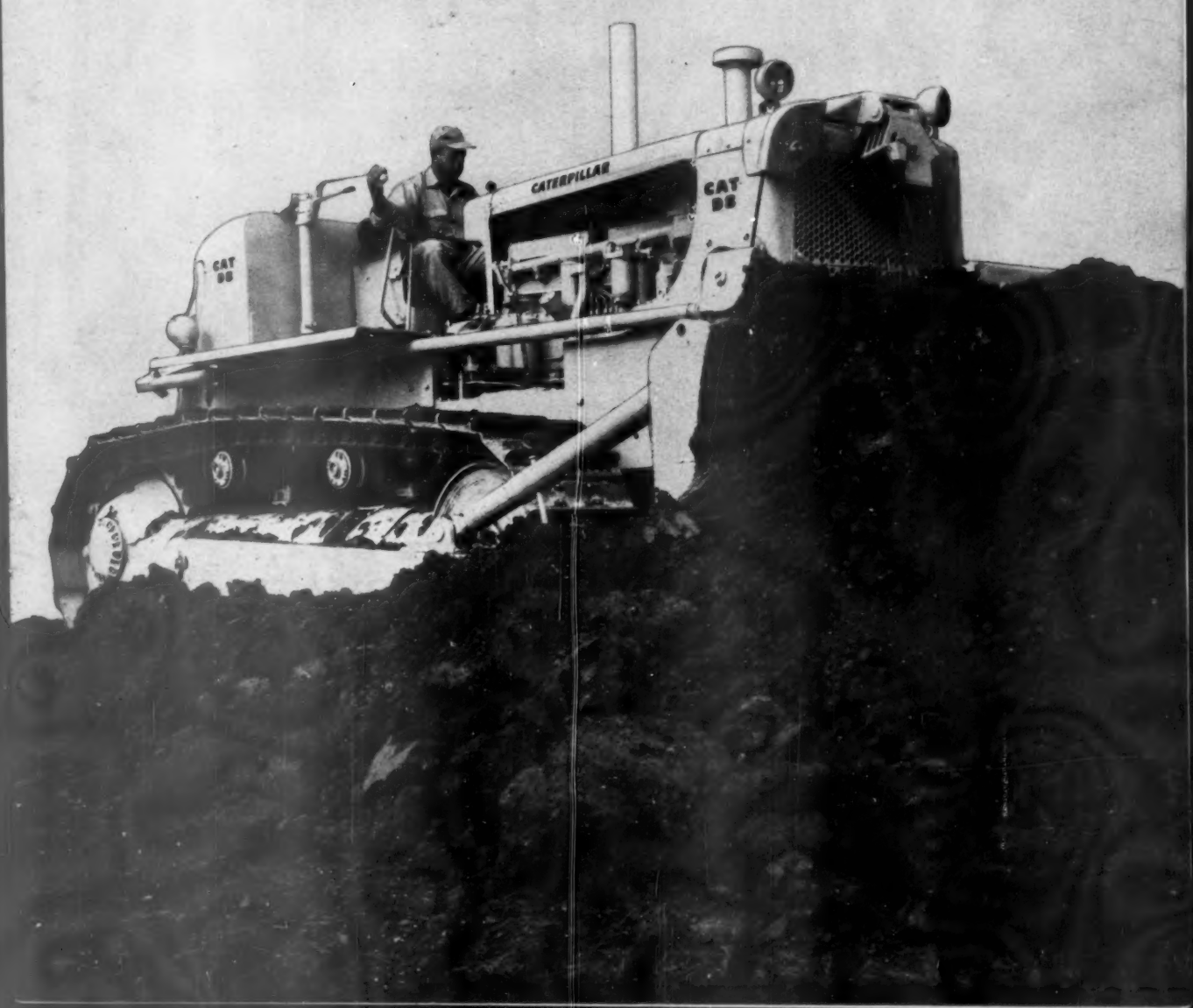

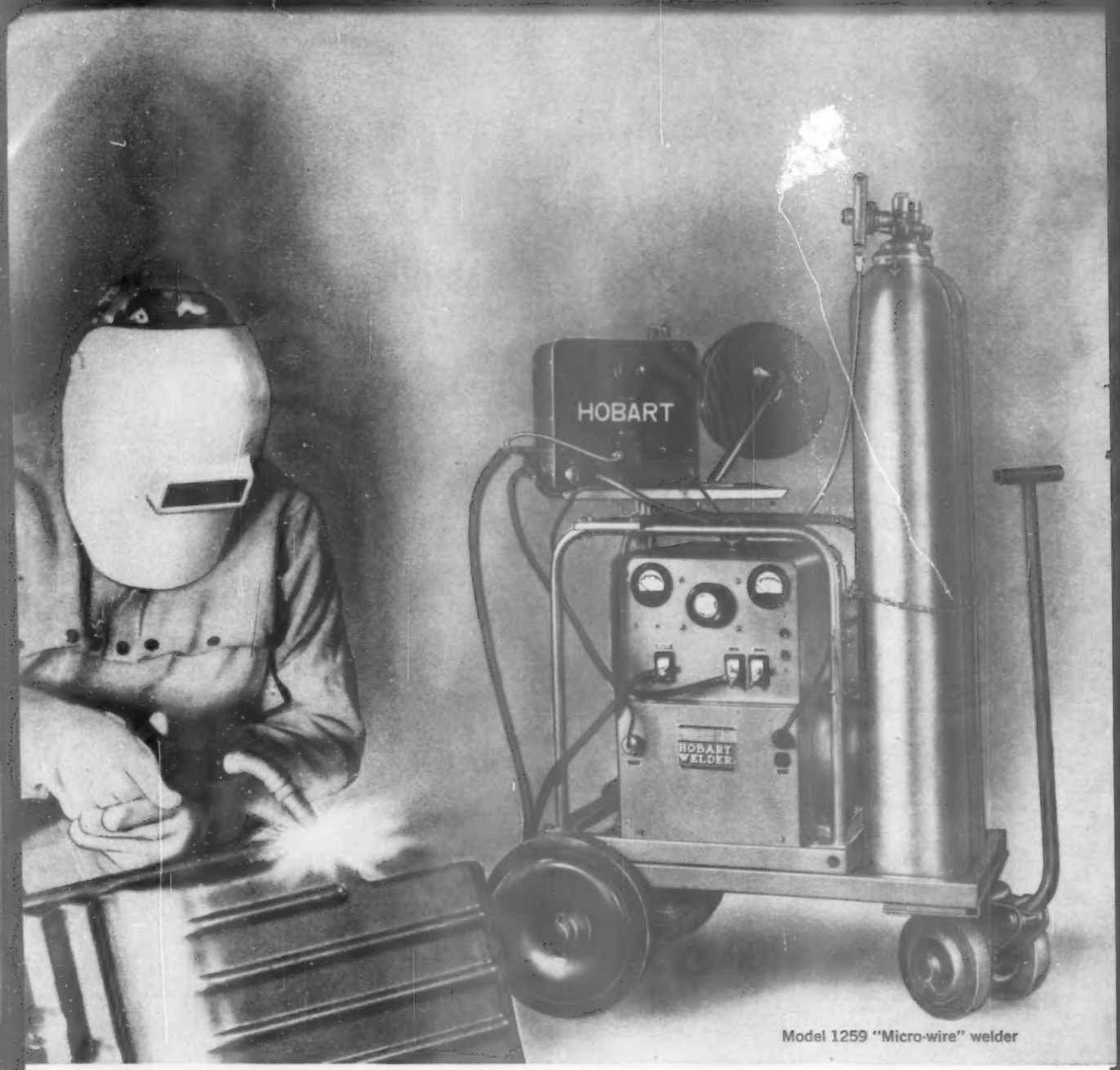

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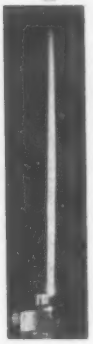
VOL. 45—No. 12

Welding Engineer

The magazine of joining and severing of materials

This is welding: December, 1960

Cover photo . . . plasma flame cutter slices through mild steel, as reported on page 33.



Plasma flame; new competition for oxy-fuel steel cutting **33**

High quality cuts, greater speeds and reduced costs are the advantages claimed for this new cutting process and demonstrated by various comparisons, as reported by **Herman C. Phelps.**

★ (For a reprint of this article, circle number 250).

Nickel steel vessels withstand pressure, impact **38**

Some 300 visitors, including *WE*, attended a dramatic demonstration which proved that these pressure vessels needed no stress relief, even when operating at cryogenic temperatures.

Grinding safety hinges on following the rules **41**

The safety chain extends from the grinding wheel and grinding machine manufacturers to the ultimate user, whose responsibilities and duties are detailed by author **Ralph N. S. Merritt.**

Tig welded insert ring helps increase pipe quality **46**

The problem of high-quality pipe joints depends on how best to make the root weld. **C. H. Voelker** describes the preplaced filler technique and the latest shape it has taken — the insert ring.

Controlled angle Tig torch simplifies cabinet welding **50**

Compactness of electronic cabinets lead one company to develop its own flexible Tig torch to overcome the problem of limited-access welding, as reported by **Forde M. Simms** and **John V. Warinsky.**

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WELDING ENGINEER is published monthly with an additional directory number in June by Welding Engineer Publications, Inc. Publication office: 600 S. Seventh St., Rochelle, Ill. ©1960 by Welding Engineer Publications, Inc. Executive, editorial and advertising offices: 5826 Dempster St., Morton Grove, Ill. Circulation office: 4050 N. Milwaukee Ave., Chicago 41, Ill. Second class postage paid at Chicago, Ill. and at additional mailing offices. Subscriptions: U. S. and possessions, $3 per year.

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How Ni-Rod "55" builds up worn cast iron... keeps repair cost down

When the owners of the M V Sunprincess heard it would cost them over $7,200 to replace all six worn ship pistons, they quickly called in J & R Weir Ltd., Marine Engineers, Montreal.

These engineers in turn recommended a Ni-Rod "55"* repair job – welding to be done by Welding Engineers Ltd., Montreal.

Wear ran as high as ⅛ inch on some of the piston ring grooves. But with Ni-Rod "55" Electrodes, welders soon had all six pistons back in the ship at a total cost of $2,450 – a saving of over $4,750.

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Using Ni-Rod "55" Electrodes, they welded cast iron inserts into position on the pistons to offset the worn areas. The pistons were pre-heated to 500°F and each of the 6 inserts welded into position with two passes by manual arc-welding. After welding, the pistons were covered with asbestos to cool. Ni-Rod "55" eliminated the need for post-heating. Then the pistons were machined and returned to the engine.

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Ni-Rod "55" can be used to build up worn areas in almost all cast iron parts. Auto, truck, or ship pistons... valve seats... cylinder walls... are just a few. And the cost is just a fraction of what replacement would cost. What's more, with Ni-Rod "55", the repair is done quickly and easily. Welds are strong, sound, highly machinable.

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America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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P.O. Box 28
Morton Grove, Ill.
Telephones:
YOrktown 5-5130, IRving 8-3355

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Single copies 50 cents. Subscription rates: United States and possessions $3 per year; $5 for two years; $7 for three years. Canada $5 per year; $8 for two years; $10 for three years. All other countries $15 per year; $25 for two years; $30 for three years. Position and company affiliation must be indicated on subscription form. Allow one month for change of address.

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LOOMING 707-ft high into the Manhattan skyline, Union Carbide Corp.'s new headquarters is the world's largest steel-clad building. Inside the building, Morse G. Dial (left), Union Carbide chairman, shows a scale model atomic research center to U. S. Atomic Energy Chairman John A. McCone (center) and Clark E. Center, vice-president of Union Carbide's Nuclear Co. in Oak Ridge, Tenn.

52-story Union Carbide building opens with atomic exhibit

A new 52-story stainless steel and glass building was dedicated recently in New York City by Union Carbide Corp.

The firm's new world headquarters at 270 Park Ave. consolidates numerous divisions in what is estimated to be the 10th tallest building in the world.

Standing 707-ft high, the huge stainless steel clad building contains 1½ million gross sq ft of space and provides offices for about 4,000 employees and the personnel of 17 tenant companies occupying 10 tower floors. In addition, four tenants occupy commercial space on the street floor.

Requiring 325,000 sq ft of glass, 30,000 tons of structural steel and 100,000 tons of concrete, the building rests on 115 steel columns.

In the lobby of the building, Union Carbide has set up a public exhibit on "Atomic Energy in Action." The exhibit begins with a panel tracing the evolution of the concept of the atom from Democritus in 500 B. C. who defined the atom as the smallest, indivisible part of matter, of which the universe is composed, to Enrico Fermi and his staff who achieved the first sustained chain reaction in 1942.

Features of the exhibit include a 60-ft mural depicting a chain reaction of splitting atoms, a huge uranium atom model, a 21-ft view of the Colorado Plateau and a full scale model of a pool-type research atomic reactor.

The entire exhibit occupies a block-long space and is designed to give the general public a better understanding of the peaceful uses of atomic energy.

According to John A. McCone, chairman U. S. Atomic Energy Commission, "In this exhibit, we witness one of the most superb educational projects ever established for the purpose of informing the public about the mysteries of the atom, the fission process, and much that can be expected from it."

Marquette announces $500,000 expansion program

Marquette Mfg. Co., Minneapolis, has announced a $500,000 expansion of productive facilities including a new plant of 21,000 sq ft and a 6,000 sq ft addition to its existing plant.

Dr. Frank W. Scott, plant manager, states this will double the firm's capacity for producing welding electrodes.

Construction of the new plant begins Jan. 1 and the plant is expected to be in operation by July 1, 1961. The building will house new automatic wire drawing equipment made in Sweden. Mill obtained hot-rolled rods will be automatically drawn to wire sizes from 1/16 in. to 1/4 in. for use in making welding electrodes.

The addition to the present plant has already been completed and houses expanded flux-mixing facilities and an enlarged research and development department as well as production space.

Welding competition opens to all shop students

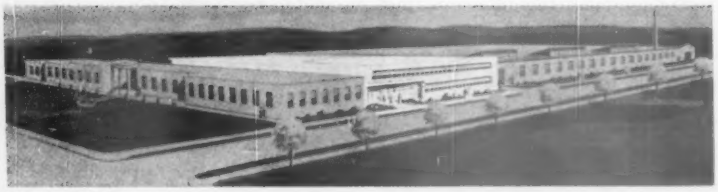
For the first time, all high school students will be eligible to compete in the $15,000 national welding award program sponsored by The James F. Lincoln Arc Welding Foundation, Cleveland.

Formerly only vocational agriculture students were eligible.

According to Charles G. Herbruck, Foundation secretary, "the competition for farm boys proved so popular we decided to expand it to include non-farm boys as well. Separate divisions have been set up to give all a fair chance to win."

Cash awards totaling $7,500 will be made in each division, agricultural education and industrial education, in the 1960-61 competition.

ALBERT E. Hackett (right), sales-engineering representative for Progressive Welder and Machine Co., Pontiac, Mich., was honored at a special recognition luncheon recently to mark his 50th year in the resistance welding field. Ray Haiden (left), president of Progressive Welder, presented Hackett with a gift to mark the event.



Eutectic welds cornerstone of new addition

With the cornerstones of Eutectic Welding Alloys Corp.'s new $500,000 addition being welded into place, the firm celebrated its 20th anniversary on Nov. 30.

A presentation of details of Eutectic's new European metallurgical center and laboratory and statement on plans for a similar center at the firm's present site in Flushing, N.Y., were also part of the anniversary observance.

The 25,000 sq ft addition is the third major expansion since Eutectic moved to Flushing 10 years ago.

The new structure, according to Rene D. Wasserman, Eutectic president, will provide additional space for offices, training, research and shipping.

Airco issues film on arc welding training

A 16mm sound and color film on shielded arc welding procedures titled, "Fundamentals of Manual Shielded Arc-Welding Techniques," has been issued by Air Reduction Sales Co., New York City.

Adapted from General Electric Co.'s previously released six-film series on arc welding, the Airco film has been edited to two reels and runs 45 minutes.

The first part covers flat and horizontal arc welding techniques; the second reel covers vertical and overhead arc welding procedures.

Regional welding shows have poor attendance

Simultaneous regional AWS welding shows were held in Boston and San Jose, Cal., from Oct. 13 to 15. Technical sections were held in conjunction with both shows.

Possibly there are too many regional shows, or maybe the fall of the year, with world series games, football games, and other distractions is the wrong time for regional meetings. Whatever the cause, attendance was poor at both affairs.

The Western Welding Show was held at the Santa Clara Fair Grounds with technical sections at the Hotel St. Claire. The technical sections were of excellent quality devoted primarily to the welding of stainless and other high nickel alloys as well as other non-ferrous materials.

There were more than 40 exhibitors at the 3rd Western Welding Show, some of whom brought exhibits in from points as distant as Chicago. While the show registration was extremely low for such an affair, visitors came from such distant points as Hawaii, Alaska, and Montana.

Welded copper tubing produced by Tubetron

The first commercially electronically welded copper tubing in the U.S. is now being produced by Tubotron, Inc., Newark, an affiliate of Eastern Rolling Mills, Inc., New York City.

The Tubotron equipment makes tubing with outside diameters from 1/2 to 3 1/2 in. with wall thicknesses from .017 to .140 in.

Pilot runs of the light-wall copper tubing have been certified by an independent testing laboratory to withstand more than 2,000 lb psi of hydrostatic pressure.

COMING EVENTS

DEC. 5-8: 1st Biennial Short Course on Welding Engineering, University of Illinois, Urbana, Ill.

JAN. 23-25, 1961: 12th Annual Plant Maintenance & Engineering Show, Palmer House and International Amphitheatre, Chicago.

FEB. 1-2, 1961: 7th Annual Midwest Welding Conference, Armour Research Foundation and Chicago Section AWS, Illinois Institute of Technology, Chicago.

MAR. 20-24, 1961: 12th Western Metal Congress, American Society of Metals, Pan-Pacific Auditorium, Los Angeles, Calif.

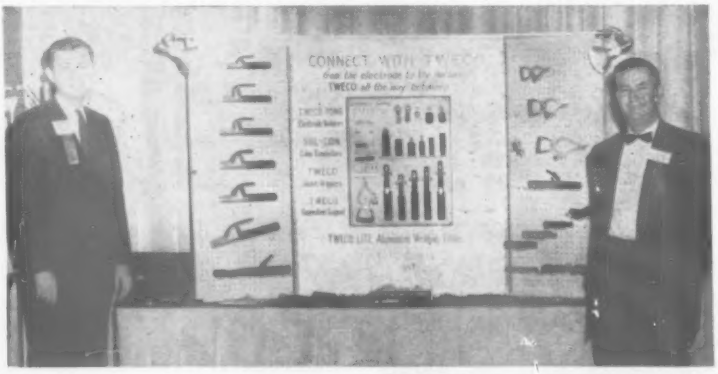
MAR. 24-25, 1961: Welding Show & Exhibit, Wichita Section AWS, Kansas National Guard Armory, Wichita, Kans.

Lukens produces 500th Nine-Nickel hemisphere

A 108-in. Nine-Nickel alloy hemisphere, the 500th produced by Lukens Steel Co., Coatsville, Pa., is destined to become a liquid oxygen storage tank for Big Three Welding Supply Co., Fort Worth.

After Charles L. Huston Jr., Lukens president, chalked a big 500 on the hemisphere, C. R. Rickel, president of Big Three, received it and stated that a 400 psi code vessel with liquid oxygen capacity of 55,000 scf having an inner shell of the alloy can be installed for $1,500 less than stainless steel or aluminum would cost.

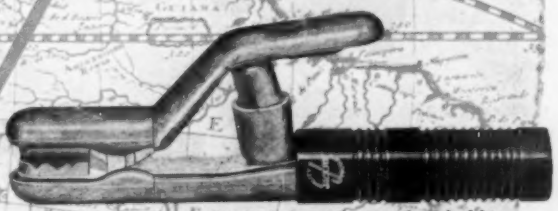
(For more on 9% nickel steel, see page 38 of this issue.)



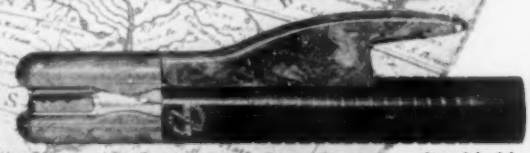
DISPLAYS at the recent New England regional welding conference and show included the one above belonging to Tweco Products, Inc., Wichita, Kans., which J. L. Townsend (left) and Donn Boring directed. At the same show, a representative of Laramy Products Co., Cohasset, Mass., (side) gave a demonstration of plastics welding.

Jackson *Featherlight* Holders

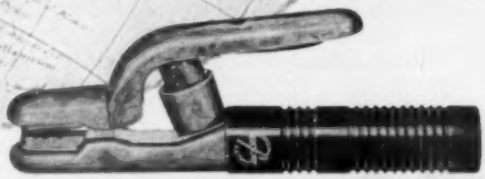
Lighten the welder's load—speed his work. Jackson aluminum-alloy electrode holders weigh up to 35% less, provide durable copper-alloy jaw inserts, and superior long lasting insulators. A Jackson pioneered product — proven good, throughout the world. Select your general duty holders from this Featherlight line.



Jackson Model A-5S, *lightest large-class holder.*
Capacity: 5/16" rods at 400 amps. (weighs only 21 oz.)



Jackson Model JH-3, *medium-class streamlined holder.*
Capacity: 1/4" rods at 300 amps. (weighs only 15 3/4 oz.)



Jackson Model A-W, *lightest medium-class holder.*
Capacity: 1/4" rods at 300 amps. (weighs only 14 oz.)

Jackson Model JH-2, *small-class streamlined holder.*
Capacity: 5/32" rods at 200 amps. (weighs only 9 1/2 oz.)

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Alloy Rods Company's ATOM·ARC "T" more than satisfied Hufford's needs. The only electrode designed specifically to weld T1 steel in all applications, ATOM·ARC "T" weld metal physical properties equal or exceed those of T1 steel in the "as welded" or "stress relieved" condition for 100% design joint efficiency. ATOM·ARC "T" electrodes are also excellent for many other applications where high strength welds are required.

Detailed application information about ATOM·ARC "T" in data sheet form is available by writing Alloy Rods Company, P. O. Box 1828, York 2, Pennsylvania.

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LINCOLN WELDERS

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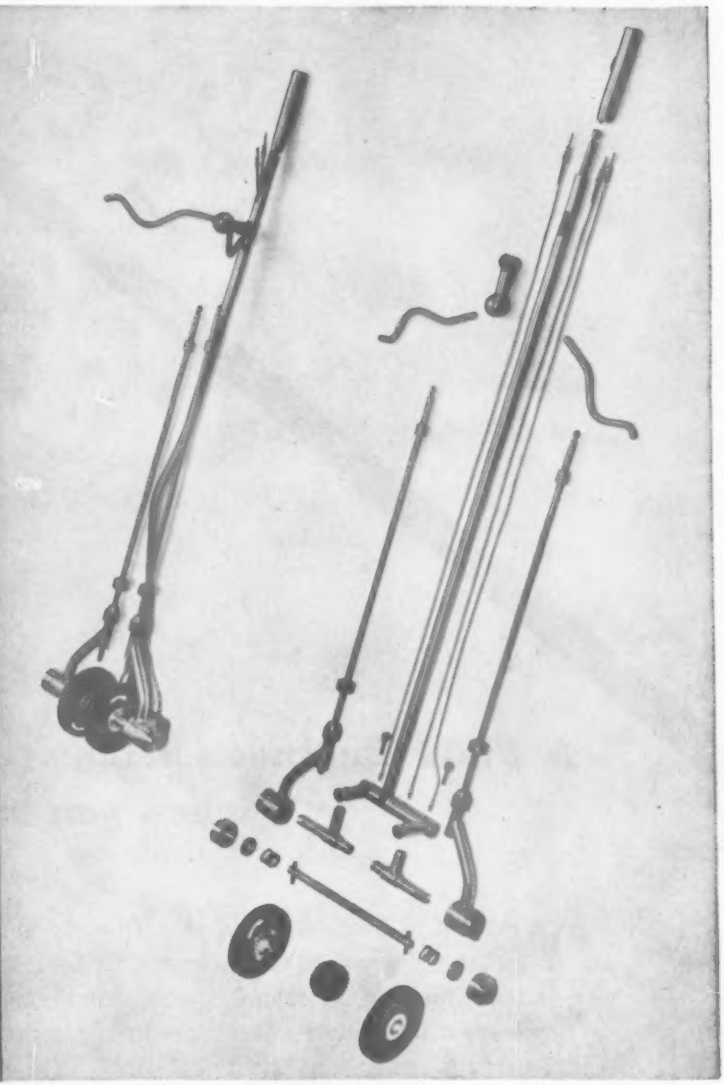
HERE'S HOW STILL ANOTHER MANUFACTURER JOINS STAINLESS STEEL TUBING:

He uses Handy & Harman's BRAZE 630



He's one of many manufacturers and fabricators who have found—to their lasting satisfaction—that Handy & Harman silver alloy brazing is the final answer to stainless steel joining problems.

Super-Donic Manufacturing Company, Atlanta, Georgia, manufactures "Dual Arm Transmissions" for the dental industry. Most everybody has—at one time or another—seen and/or felt this unit in operation.

It is fabricated of small diameter 304 and 316 stainless steel tubing and, in its assembled form, consists of some 17 separate brazed joints. Joints must be strong, corrosion resistant and neat-appearing.

Each of the 17 joints is hand-torch brazed with Handy & Harman BRAZE 630 wire and HANDY FLUX TYPE B-1. There's no question that this is a unique application. There's no question, either, that the application is stainless steel. The ease and economy with which this manufacturer solves his problems can be just as readily applied to *your* stainless steel joining problems.

Strength, production speed, electrical and thermal conductivity, gas and liquid tightness and low cost are *natural* benefits of silver alloy brazing. We think it worth your while to learn more about this remarkable metal-joining method—we'll be glad to send you any information you ask for. Handy & Harman, 82 Fulton St., New York 38, N. Y.

FOR A GOOD START: BULLETIN 20

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On production line welding at Parish Div. of Dana Corporation

UNIFORMITY OF PAGE WIRE CUTS DOWN-TIME

These Folders can help you

Write for:

Folder DH-402-C Contains information on submerged arc and inert gas automatic welding wire. Lists descriptions and uses of the many PAGE analyses. Describes our extensive variety of packaging. Illustrated.

Folder DH-1218 • Chart lists detailed analyses of PAGE automatic welding wires, metal spray wires, bare electrodes and gas welding rods. Shows uses and physical properties. Lists most competitive makes.

500# Payoffpaks of PAGE welding wire provide continuous feed with no down-time for reel or coil changeovers at Parish Pressed Steel Division of Dana Corporation. Those shown above, for instance, feed CO_2 welding machines used to produce motor mount members of automobile frames.

As a major automotive supplier, Parish demands uninterrupted production of extremely high quality. Parish specifies PAGE welding wire not only because they can get the correct wire analysis, but also because PAGE wire offers uniform temper and finish plus consistent metallurgical characteristics. These factors, combined with the right packaging, help Parish maintain quality, minimize down-time.

Let PAGE help solve your welding problems • From PAGE, you get over half a century of wire drawing experience and leadership in metallurgical research. From 33 welding wire analyses, PAGE can furnish the right wire for your job. Every modern form of packaging is available for convenient storage and handling. Prompt delivery is assured by a coast-to-coast network of PAGE distributors and warehouses. Bring your welding problems to PAGE—we'll be glad to help you improve your quality and lower your production costs.

ACCO **PAGE WELDING WIRE**

Page Steel and Wire Division • American Chain & Cable Company, Inc.

Monessen, Pa.*, Atlanta, Chicago*, Denver*, Detroit, Houston*, Los Angeles*, New York, Philadelphia*, Portland, Ore., San Francisco*, Bridgeport, Conn.

*Indicates PAGE warehouse stocks

PAGE—*THE SOURCE FOR ANSWERS TO WELDING PROBLEMS*

Phelps Dodge Habirprene* Arc Welding Cable

lasts longer under roughest working conditions!

The durable quality of Phelps Dodge Habirprene arc welding cable makes it ideal for use on jobs where welding cable undergoes severe physical wear and tear. Records show that Habirprene cable more readily absorbs heavy blows and weights, resists oxidation and damage caused by severe working conditions in shipyards, oil refineries, building construction and boiler-making plants. In some applications, Habirprene cable has lasted many times longer than rubber cable.

More than 10 years ago, Phelps Dodge pioneered Habirprene welding cable—the first real advance in this field. Today's Habirprene welding cable is the result of Phelps Dodge development and manufacturing experience devoted over the years to providing an arc welding cable of superior quality with a proven record for safety, dependability and long life. This cable meets all requirements of A.S.T.M. D752.

See your authorized Phelps Dodge distributor for hard-wearing, long-lasting Habirprene arc welding cable with indelible gold markings. Phelps Dodge also makes a full line of rubber arc welding cable and welding power supply cable. All these cables are available from stock.

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PD

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WELDING ENGINEER

Your December, 1960 *Weld World*

As WE went to press, these were the industry's latest developments:

. . The Secretary of Defense has advised Sen. John Sparkman, chairman of the select committee on small business, that the Air Force has changed its plans for procuring oxygen generating plants and that "the revised policy . . . is in consonance with the stated desires and objectives" of the committee. The Air Force will now purchase liquid oxygen . . . from commercial sources wherever possible, and supplies for bases in the United States, its territories and possessions will be protected by . . . sufficient storage capacity. Sen. Alan Bible, chairman of the subcommittee which studied the proposed purchase of some 70 plants, hailed the new Air Force policy as removing a threat to the continued existence of a number of small, independent businesses.

. . A mobile plant for field production of acetylene for cutting and welding has been developed by the U. S. Army Research and Development Laboratories, Fort Belvoir, Va. Utilizing a hydrocarbon fuel (JP-4 jet fuel) rather than calcium carbide, the generator's production capacity is designed for 500 cfh. Although the military has standard mobile plants using calcium carbide, there was a requirement for a unit using a raw material other than calcium carbide — a single purpose military supply item.

. . The major portion of Linde Co.'s Tig torch line, including those in service, now can be adapted for cutting. Cutting is accomplished by increasing current density above good welding conditions, while using argon-hydrogen shielding mixtures. Normal gas flow rates of 40-60 cfh are sufficient to transfer energy across the arc and displace molten metal. Good kerf quality is obtained on one side, but the other side of the cut is trimmed away as scrap.

. . Coyne Cylinder Co., through an exchange of stock with American Cryogenics, Inc., has consolidated with Acetylene Cylinder Corp., Far West Equipment Corp., both of San Francisco, and Sierra Oxygen Co., Reno, Nev. McKesson Appliance Co., Toledo, has been purchased by American Cryogenics, which is also the owner of Marks Oxygen Co., Augusta, Ga. Coyne's cylinder manufacturing and distributing activities and McKesson's medical therapy equipment will further integrate operations of the parent firm. M. F. Coyne, John P. Coyne and L. W. Fleischer of the Coyne group have been elected officers and directors of American Cryogenics.

. . Insto-Gas Corp., Detroit, has acquired Sun-Heat, Inc., Holt, Mich., producer of electric heating devices for industrial as well as residential and commercial uses. Insto-Gas manufactures LP-gas portable heaters. Sun-Heat's operations will continue at Holt, and James Martin will remain as manager.

(continued on next page)

Weld World...

. . Square-butt, or high-current, Mig welding of 1¼-in. thick aluminum is reported by National Steel and Shipbuilding Co., San Diego, and Linde Co., New York City. Vee-joint preparation, preheating, back chipping, etc. are eliminated; only clean square ends are necessary. One-pass welds on either side (at currents well above 400 amp) result in full build-up and penetration. More details next month.

. . Minnesota Mining & Mfg. Co., St. Paul, plans to build a coated abrasives plant in Australia. It will be located at the site of the present 3M plant at St. Mary's, New South Wales.

. . Study of electron-beam welding for electrical connection micro-assemblies is being undertaken by Hamilton Standard Div., United Aircraft Corp., Windsor Locks, Conn. Contract was awarded by U. S. Army Signal Corps. Micro-assembly wafers are presently joined by soldering.

. . Expanding plasma field recruits another member: Amperex Electronic Corp., Hicksville, N. Y., has developed a plasma torch that operates by using energy of a high frequency electromagnetic field to break up and ionize gas molecules into component atoms. The gas—nitrogen in this case—is allowed to recombine into its original state, and absorbed energy is liberated in form of heat. Gas is never consumed, Amperex says, and can be used again and again.

. . First intensive American study of friction welding shows that a layer of fluid metal is formed at interface of metals being joined. Researchers at American Machine & Foundry Co.'s Central Research Laboratory, Stamford, Conn., investigated friction welding of mild and stainless steels, brass, aluminum, copper and zirconium. More details next month.

. . The James H. McGraw Manufacturers Medal was awarded to James F. Lincoln, board chairman of The Lincoln Electric Co., Cleveland, by the National Electrical Manufacturers Association on Nov. 17. He was cited for his "outstanding leadership and inspiration in the creation and development of the electric arc welding process and industry."

. . Resistance-welding equipment manufactured by Thomson Electric Welder Co., Lynn, Mass., can now be leased through a plan formulated by Thomson and General Electric Credit Corp. On request, welding machines — either standard or modified to requirements — are leased for a maximum of 60 months. Numerous options are available, including time payments whereby the customer purchases the equipment.

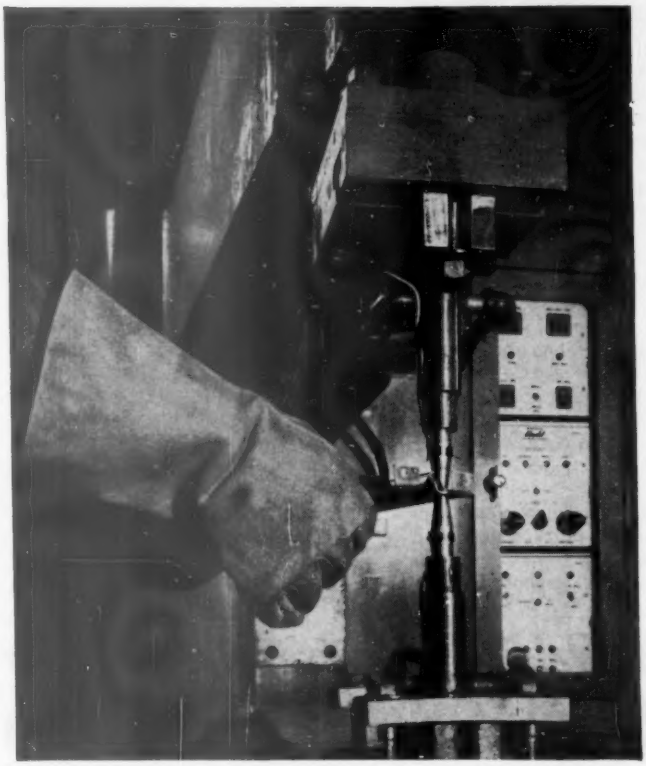
. . Gulton Industries, Inc., Metuchen, N. J., has purchased the electronic business interests of the Mullenbach Div. of Electric Machinery Mfg. Co., Los Angeles, a subsidiary of Worthington Corp.

. . Explosive forming has been used as a production process for sometime. Now Rocketdyne, a division of North American Aviation, Inc., Canoga Park, Calif., reports successful experiments in explosively flattening metal sheets that have warped during welding or heat treat processes.

. . Shipments of resistance welding equipment continue at high level, belying some other areas of the welding sales picture. For the eighth straight month, shipments surpassed the $2 million mark, according to RWMA. New business, as well as shipments, showed a gain for first three quarters as compared with last year

. . The first offsetting machine for pipe has been developed by The Webb Corp., Webb City, Mo. It will offset pipe from 6 in. to 30 in. in diameter, enabling automatic welding without need for any backup.

NEW FEEDBACK CONTROL
makes every weld count



Information from electrodes is fed back to **Monautronic V-2** in background. Control has fully automatic sequencing with all provisions for single spot, roll spot and seam welding.

Now, with the new **Monautronic V-2** welding control, you can make consistently top-quality welds over long stretches of time, without stopping to test and inspect sample welds. The control senses variations in line voltage, electrode shape and tip force, material thickness and surface finish . . . and compensates for them immediately.

The **Monautronic V-2** automatically compares actual voltage across the weld with command voltage, and adjusts current accordingly to maintain voltage—and weld quality—at a constant level. If weld resistance is too high or too low to produce a good weld, the control locks out until the condition is corrected.

Although the **Monautronic V-2** embodies the latest advances in computer-type circuitry, it is quite simple to operate, and easier to maintain than most conventional controls. For complete details, contact THE BUDD COMPANY, Electronic Controls Section, Philadelphia 32, Pa., or one of our regional offices.

Here's a typical example of how **Monautronic** Welding Controls pay off. The part at the left is fastened by butt welding a piece of square cut mill bar stock to the side of a section of thick-walled tubular stock. With conventional control, 100% inspection at 8000 pounds pull revealed that approximately 5% of the assemblies ended up in the scrap pile. With **Monautronic** Controls, failures were cut to less than ¼ of 1%. The few times failures did occur, the **Monautronic** Control locked out automatically indicating a low quality weld. The piece at the left failed at 14,000 pounds. Notice that the nugget is almost as large in diameter as the bar stock.

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ELECTRONIC Budd CONTROLS

For more facts Circle No. 164 on Reader Service Card

Letters . . .

Letters should be addressed to: The Editor, The Welding Engineer, P. O. Box 28, Morton Grove, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Piping industry

Sir: *Salem, Ohio*

Congratulations on your October issue . . . I've known for some time that automatic welding of pipe could be done without back-up rings and without a manual root pass, but I couldn't get anyone to "buy it."

Thanks again for a job very well done. I feel you have accomplished more toward promotion of automation in the piping field than the combined efforts of all the equipment manufacturers.

Please send us two dozen more complete issues so we can send them to our dealers to make sure they do not miss out on this informative issue.

S. A. Grubish
President
Steffan Mfg. Corp.

"Burning" copper

Sir: *Providence, R. I.*

In the October 1960 issue an article which appeared on page 60, *Silver-bearing solder solves copper piping problem,* causes some concern. The particular point with which we take issue is the statement that appears in paragraph three which, in substance, states that copper burns at 1,100 F. This, as you know, is not true and undoubtedly will cause some confusion among the tradesmen using the higher content silver brazing alloys.

We think that some type of modifying or corrective statement should be issued since your publication has substantial weight as an authority on welding and brazing and when people say, "I saw it in WELDING ENGINEER so it must be true," we want them to know that they are . . . correct.

W. T. San Souci
Sales Manager
United Wire & Supply Corp.

(Like many other words and phrases that have crept into our language and our technical terminology, the word "burning" in this article was used in the vernacular. Many operators continue to use this trade expression when they mean oxidizing and annealing of copper tubing. We regret any misinterpretation. — Ed.)

Plastic welding

Sir: *Sharon, Mass.*

In the October 1960 issue of *WE,* page 12 (Letters . . .) you refer Mr. Watkins and Mr. Thrapp to two companies for further information on plastic welders for thermoplastics.

One of our clients, Kamlar Products, 932R Washington St., Norwood, Mass., is one of the earliest manufacturers of plastic welding equipment. In fact, this company introduced high-speed plastic welding for the first time. Mr. S. J. Kaminsky, president of Kamlar Products Co., holds two patents in his name covering plastics welding equipment.

Adolf W. Arnold
Engineered Advertising

The Most Advanced Line of Welding Aids Ever Produced for

PIPE-LAYOUTS of ANY Type or Location

CURV-O-MARK

CONTOUR MARKERS

Marks off any pipe joint or structural angle cut accurately, easily and without figuring cutbacks. Marks all around pipe—saves time and gas. Available in 2 sizes of 1½" to 18" in cross-section, 16" to 48" diam.

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CENTERING HEADS

Really, 5 tools in one—it replaces Protractor, Centering Head, Center Punch, Level and Scale. Eliminates difficult measuring, checking and marking. Pocket size—weight only 9 ozs.

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RADIUS MARKERS

Has marking span of 24" and swings to 48" circle or arc. Pencil holder accommodates round or flat pencils, soapstone and steel points. Unequaled for accurate layout work. Wt. 8 oz., pocket size.

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For Aligning Slip-on, Top Joint, Stub End and Welding Neck Flanges. This self-centering Tool is quickly adjustable for all types of Flanges or Pipe sizes from 3" to 12" in diameter.

CURV-O-MARK

Ang-Lo-Cator Protractor

An easy way to find accurate angles on pipe and structural material. A valuable aid to weldors, structural workers and pipe fitters. Size 4" x 8"

Your Welding Supply Dealer Recommends all CURV-O-MARK Products

CONTOUR SALES CORPORATION
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Hurricane hits

Sir: *Mattapoisett, Mass.*

My September copy of WELDING ENGINEER magazine was delivered last week on the day the hurricane struck here. The magazine was ruined by the rain and wind.

I hope that I may obtain another copy of the September issue.

It is a fine magazine. I read it from cover to cover every month and refer to my back copies many times. The articles and advertisements are all timely and most informative.

Linwood R. Bailey, Jr.

Excellent job

Sir: *Chicago, Ill.*

An excellent job on the October issue of WELDING ENGINEER. The color is most effective.

Howard E. Adkins
District Engineering Department
Kaiser Aluminum & Chemical Sales, Inc.

Welding promotion

Sir: *Dallas, Tex.*

Enclosed is an article taken from the Dallas Times Herald, Aug. 9, I thought you would enjoy reading.

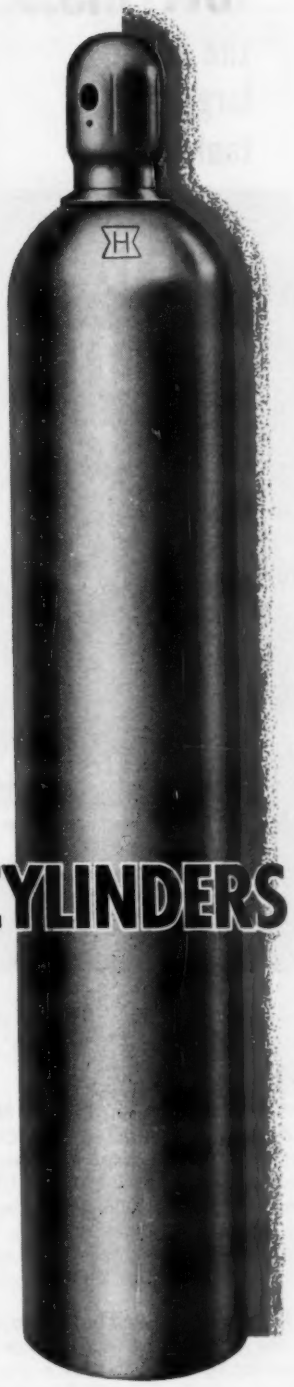
During your years of experience in the welding industry, and particularly during the recent years of promoting National Welded Products Month, you have undoubtedly had a number of ideas of ways that an individual firm, operating in a local area, could promote welding. We would appreciate sharing with you some of these ideas. We at Welders Supply would like very much to become a more useful and active outlet for distributing information about our industry and the roll it plays in our national economy to the general public.

Charles E. Squibb
Welders Supply Inc.

(The article which Mr. Squibb enclosed opens with a brief recap of the historical progress of welding. It then shows the importance of welding on a national scale and leads into a discussion of welding in the Dallas-Fort Worth area. The article discusses Welders Supply Inc.'s program of furnishing supplies and services to the industry. — Ed.)

Coming next month. *Welding Engineer's* 45th anniversary issue.

1ST IN QUALITY AND PRODUCTION

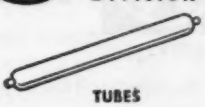


HARRISBURG CYLINDERS

Because Harrisburg Steel has never settled for anything less than the best in quality controls and production methods, the service life of their gas cylinders, which is usually over 30 years, has become the basis of standards for the industry. No other cylinder manufacturer can make this claim for only Harrisburg and Taylor-Wharton, both divisions of Harsco Corporation, have made cylinders for over 30 years.

More than a Century in Harrisburg 8, Pa.

H HARRISBURG STEEL CO.
Division of HARSCO CORPORATION


TUBES

TRANSPORTS

FLANGES

COUPLINGS

For more facts Circle No. 166 on Reader Service Card

ON THIS, the World's largest tank car,

WELD QUALITY PROVEN... X-RAYED BY

CURTISS WRIGHT
FEDREX
RADIOGRAPHY EQUIPMENT

There can be no guess-work about the welds in this huge carrier of L-P gas under pressure.

That's why Graver Tank & Mfg. Co., a division of Union Tank Car Company, utilizes the safe, fast and easy-to-use Curtiss-Wright portable FEDREX X-ray Unit — to assure weld quality throughout the 85-foot length of this tank for the world's largest railroad tank cars being built by Union Tank Car Company.

Recently fabricated by Graver, it is one of the first of such tanks, each 8′3″ in diameter by 85′ long with a capacity of 30,000 gallons of liquified petroleum gas under pressure.

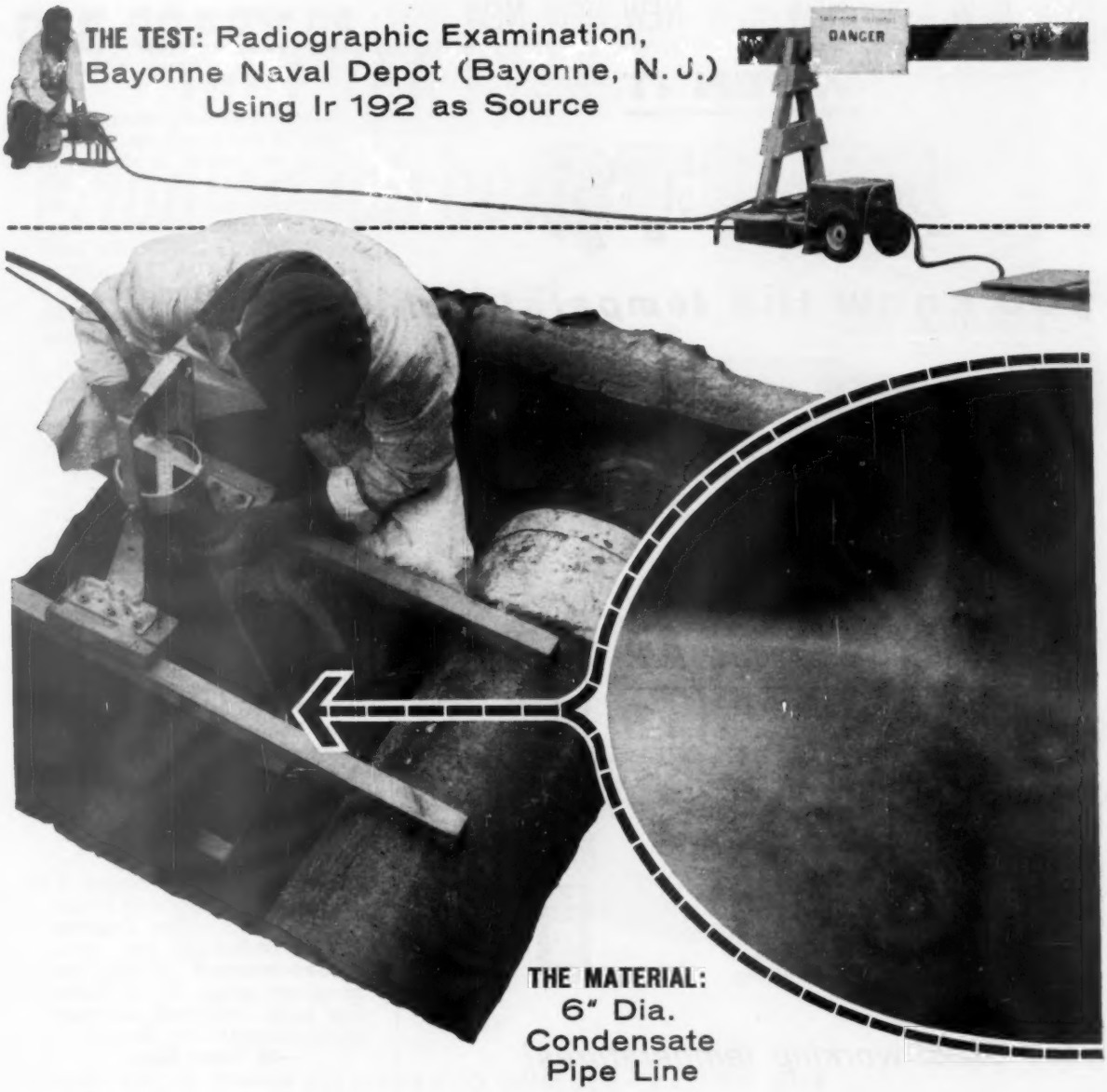
FEDREX units are the most compact and versatile in their KV range, and have proved most effective on materials from thin plastic to four-inch steel plate. They are available in 140, 160, 200 and 260 KV models adaptable to 110, 220, or 440-volt power input. The unit used on the L-P tank car welds has a KV range from 85 to 260 . . . a milliampere range of 2.2 to 5. Superior shielding keeps stray radiation down to 5 mr/hr or less at ten feet. High maximum current ratings result in shorter exposure time . . . more exposures per day and less production interruption.

Send for the FEDREX Bulletin or phone SWinburne 9-0500.

According to Mr. Clarence Unger, Chief Inspector at Graver, the FEDREX unit is rugged, dependable and easy to use. Shown in operation is the Curtiss-Wright 260 KV FEDREX X-ray unit on stand under control of operator. X-ray film is inside the tank.

Princeton Division **CURTISS WRIGHT** Princeton, New Jersey
CORPORATION

In CANADA: Canadian Curtiss-Wright Ltd. • 43 Westminster Avenue, North • Montreal 28, P. Q., Canada



THE TEST: Radiographic Examination, Bayonne Naval Depot (Bayonne, N. J.) Using Ir 192 as Source

THE MATERIAL: 6" Dia. Condensate Pipe Line

THE FILM:

GEVAERT **STRUCTURIX D7 X-Ray Film**

Gevaert STRUCTURIX D7 X-Ray Film was used exclusively by the New York Testing Laboratories, Inc., for examining corrosion of steam line pipe walls at the Bayonne Naval Depot. Pipe sizes ranged from 1" diameter copper tubing, to 12" diameter steel schedule 40 extra strong steam pipe.

Gevaert STRUCTURIX D7 is chosen in laboratory and field testing for its maximum sensitivity to gamma ray exposure, and assures positive identification of the most hidden signs of corrosion or defective material.

Gevaert STRUCTURIX Films are available in five types, packed in standard sheets and rolls, in Uni-Pak (individual disposable cassettes) and in Bi-Pak (for multiple film technique). Each type is available in a wide range of economical sizes, and is designed to excel in its specific job application. Your inquiry for complete details and professional samples will be answered by the Gevaert Branch nearest you.

FREE! *Write for a Handy Exposure Calculator for either Ir 192 or Co 60 Radiography. Specify the one desired.*

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NEW NEW NEW NEW NEW NEW NEW NEW NEW

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MELTS

you know the *temperature!*

NEW Markal® THERMOMELT TEMPERATURE INDICATORS

the exact working temperatures!

Just mark or stroke the surface with THERMOMELT . . . when it reaches the desired temperature, the mark liquefies. There's no guesswork, no wasted time or material . . . THERMOMELT is the quick, precise way to determine heating temperatures. Accurate to within ±1%.

A STIK FOR EVERY TEMPERATURE from 113°F. to 2000°F.

ALSO AVAILABLE IN LIQUIDS AND PELLETS for inaccessible or hard-to-measure applications. Wide range of temperatures.

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30 YEARS AGO

(Taken from **WELDING ENGINEER** of December, 1930).

Among those presenting papers at the recent arc welding clinic conducted in Milwaukee by Marquette University and Northwestern Mfg. Co. were L. C. Monroe and H. S. Card of WELDING ENGINEER. Monroe's talk was on "The relation between quality and economy;" Card's on the "Future for engineers in the welding industry."

—30 Years Ago—

H. M. Priest, assistant engineer of American Bridge Co., New York City, discussed the application of arc welding to bridge construction at the 40th annual convention of the American Railway Bridge and Building Association in Louisville, Ky.

—30 Years Ago—

An experimental torch for breaking up concrete was recently completed by Smith Welding Equipment Corp., Minneapolis. The brainchild of Elmer Smith, president, the oxyacetylene torch is 6½ ft long, including tip, and weighs 35 lb. Length of the flame envelope is 3 ft.

—30 Years Ago—

The Lincoln Electric Co., Cleveland, has appointed S. H. Taylor, Jr., to head its Pacific Coast offices at Los Angeles. L. P. Henderson has been named manager of the San Francisco office. E. J. Pfister has been appointed manager of the Kansas City district.

—30 Years Ago—

An editorial in this issue cites a talk by P. H. Wood, Converse Bridge and Steel Co., Chattanooga, in which he states that "it is possible to design steel srtuctures of such outstanding beauty that they will be beyond competition of other materials." (Coincidentally, in this December, 1960, issue, on pages 42-43, the latest winning "beautiful bridges and buildings" are depicted.)

Coming next month:

WELDING ENGINEER's 45th Anniversary Issue. The basic processes. Comments from leading welding engineers.

Do EVERY grinding job better

From lightest to heaviest work, Norton wheels bring you profit-boosting performance

Norton portable wheels include all standard types, as well as the increasingly popular reinforced types. All are engineered for maximum strength, safety and versatility. All are built to *hug that work*, with less vibration and bounce.

In straight, cup and cone types you can get 44 ALUNDUM abrasive and the B-11 resinoid bond. "44" is non-premium priced, cutting faster, grinding cooler and lasting longer than similarly priced aluminum oxide abrasives. B-11 resinoid wheels are more uniform in structure, better balanced, made to closest duplication and available in half-grade increments across the entire hardness scale.*

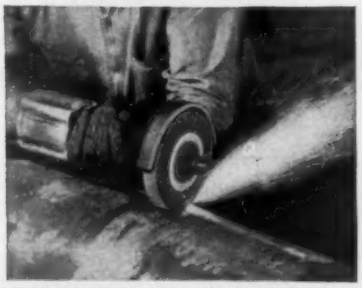
Among the various Norton reinforced wheels, the rigid Type BDA and semi-flexible Type BFR are an unbeatable team for usefulness. Separately, each handles many grinding jobs. Together, they cover an almost endless list of applications.

Ask your Norton Distributor how these fast, tough wheels can benefit every grinding job you do. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U.S. Pat. Off. and Foreign Countries

NORTON
ABRASIVES

STRAIGHT–CUP–CONE WHEELS



Straight Wheel makes short work of smoothing a heavy weld.

Flaring Cup Wheel (available with built-in reinforcement in size 6/4¾" x 2") saves time and work on many welds.

Cone Wheel is easier to use in hard-to-reach spots like this.

REINFORCED WHEELS – RAISED HUB

The Rigid Type is ideal for heavier weld grinding, smoothing flame-cut edges, slotting, notching, cutting-off, etc. Reinforced with glass cloth and Nylon.

The Semi-Flexible Type excels in light weld grinding, removing scale, blending contours, scarfing and beveling before welding. Reinforced with cotton fabric and Nylon.

W-1947

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electro-Chemicals — BEHR-MANNING DIVISION: Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

At Kaiser Steel Corporation's Fabricating Division, a Model 30 Iriditron is used to spot-check plate welds on the bow section of a steel barge. Light and easily carried, requiring no outside power supply, the Model 30 uses iridium 192. It can take internal and panoramic exposures not possible with standard equipment.

Remote control of iridium . . . with Budd Iriditron units

- **Especially designed for remote handling of iridium 192**
- **Excellent for panoramic and internal exposure**
- **Permits exposure of iridium sources by remote control as far as 50 ft. away.**

Skid mounted or portable, this Budd Iriditron unit provides all the versatility of the traditional unshielded source for pipe weld radiography, panoramic exposure of multiple specimens, circumferential and longitudinal welds in boilers and pressure vessels. The unit can hold extremely strong sources . . . as much as 30 curies of iridium 192, approximately equivalent to a 260 KV X-Ray machine. This adds up to significant reductions in exposure times.

And you get complete service from Budd—including radioactive source supply and encapsulation, source replacement and disposal, training for your personnel (at no charge) and aid in setting up complete radioactive facilities.

Write or call Budd Instruments Division for our Gamma Radiography Bulletin . . . or for a consultation on your requirements.

INSTRUMENTS Budd DIVISION

THE BUDD COMPANY • P.O. Box 245 • Phoenixville, Pa.

Consult your phone book for sales offices in: Atlanta, Ga., Oak Park, Ill., Dallas, Tex., Los Angeles, Calif.
In Canada:
Budd Instruments, Ltd., 170 Donway West, Don Mills, Ont.

Between passes

at the Smithsonian

Now under construction in Washington, D. C., is the newest addition to the Smithsonian Institution — a Museum of History and Technology that is fast becoming a showcase for American know-how and initiative, both inside and out.

Inside will be displayed historically outstanding examples (originals and models) of U. S. ingenuity: Thomson's resistance welder, Whitney's cotton gin, Bell's telephone, etc.

Outside, the building itself, on the Mall at Constitution Ave. and 14th St., serves as a modern example of that same kind of ingenuity. Its unusual structural requirements have caused U. S. Steel's American Bridge Division, which is erecting the framework, to pull some engineering rabbits out of their construction hats.

One of these is heavy welding.

Because of the size and weight of the exhibits to be housed in the new addition, floors must bear double the strains and stresses of those in other large buildings. Also, supporting columns are about 50 ft apart, as compared with the normal 25 ft.

The design of the Museum calls for steel beams weighing as much as 22 tons (about three times the weight of those used in routine construction). According to Elmer Olson, veteran construction superintendent for American Bridge, the unusual heavy welding necessitates ¼-in. diameter electrodes instead of the 3/16 or 5/32-in. electrodes normally used by his crews in construction work.

Two derrick cranes — each 65 ft high with a 120-ft boom and a hoisting capacity of 100 tons — work as a team in erecting the steel beams. Because the unique design of the building called for the pouring of concrete on the ground floor first, rather than erecting the steel frame, these cranes had to be placed on runners, or tracks, along the periphery of the second-floor framework. To anchor them and provide counterweight, the cranes are hooked to six 25-ton pontoons, which rest on the ground several yards from the building.

The Museum, which will occupy a city block, will contain about 13,000 tons of steelwork.

Words worth quoting

"I believe there is absolutely no justification for complacency about the future. If we allow ourselves the luxury of complacency, the current crop of pessimists will some day be honored as prophets. So you see, it is not my intention to infer that it will be 'business as usual' in the next decade."

—John F. Smith, Jr., president, Inland Steel Co., before the annual convention of American Institute of Steel Construction, Oct. 31, 1960.

magnetism

Du Pont Co. scientists have discovered a new metallic compound—chromium manganese antimonide—with unique on/off magnetic properties. It becomes more magnetic as temperature rises above a point predetermined by its chemical composition. It is non-magnetic below that point.

meet competition

Like the steel industry in general (see *WE*, July, p. 32), the structural steel people have instituted an intensified program to combat the challenge of competing materials.

A survey made by the American Institute of Steel Construction among its more than 300 members indicated approval of the organization's current activities, but members want a stronger campaign to stress steel's construction advantages of speed, strength, durability and economy.

Survey respondents were unanimous in declaring the need for such a program to tell steel's story to owners, architects, engineers and contractors.

name, please

The inquiry cards bound in the back of each issue of WELDING ENGINEER are there for the convenience of you readers. But . . . we cannot process cards that have not been filled out completely. Many of you neglect to circle appropriate numbers; others forget to give us their names and addresses.

An example of the latter: *WE* received a card with seven numbers circled, but no name. It came from an overseas reader in Tel Aviv, Israel, according to the postmark.

Complaints about failure to receive the materials requested often come from persons who forgot to give all the necessary information. Naturally, all we can do with such a card is to file it in the waste basket.

How long have you been reading WE?

We are searching for a subscriber — the subscriber who has been receiving WELDING ENGINEER longer than anyone else.

In conjunction with our 45th anniversary, which will be marked with the January issue and which will be celebrated throughout 1961, we hope to give public recognition to the reader who has been our most faithful adherent.

If you have been subscribing continuously for many years, please send your name, address and the date you first became a subscriber to: The Editor, WELDING ENGINEER, Box 28, Morton Grove, Ill.

We hope to announce the name of our senior subscriber in the special January issue that will commemorate our 45th year.

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DECEMBER, 1960

Welding Engineer

ESTABLISHED 1916

The easy (?) way

WHEN THERE IS A DIFFICULT JOB to be done, give it to the laziest man in the organization; he will find the easiest way to do it. Then adopt that system.

But the easy way is not necessarily the right way!

For example, two weldors recently tried this method. First, they "eye-measured" a piece of metal they were flame-cutting; it came out too long. So it was cut again — still without proper measuring — and then it was too short. By slugging in an electrode in welding over the too-wide gap, they made the short piece suffice.

The "easy" way required double flame-cutting and probably twice as much welding as the right way. *And the weldors didn't seem to care!*

Perhaps they didn't realize it, but this type of work helps price welding out of the market — and themselves out of a job.

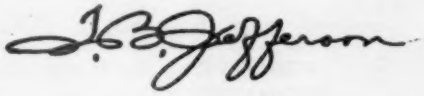
Everyone engaged in welding activities should take pride in his work. Most weldors do, but there are always the inevitable few whose motto is the less work done, the better.

Welding has been long noted for offering certain basic advantages in the fabrication of metal goods: lighter weight, greater strength, more pleasing appearance and lower cost.

These four aces are a hard-to-beat combination, yet some weldors are throwing in their hands without looking at the cards.

Only time will tell what the future holds. As we look at the inroads other joining methods are making, we can see that many weldors are pricing themselves out of a job by not giving an honest day's work for an honest day's pay.

The easiest way may prove to be the wrong way for the long pull.



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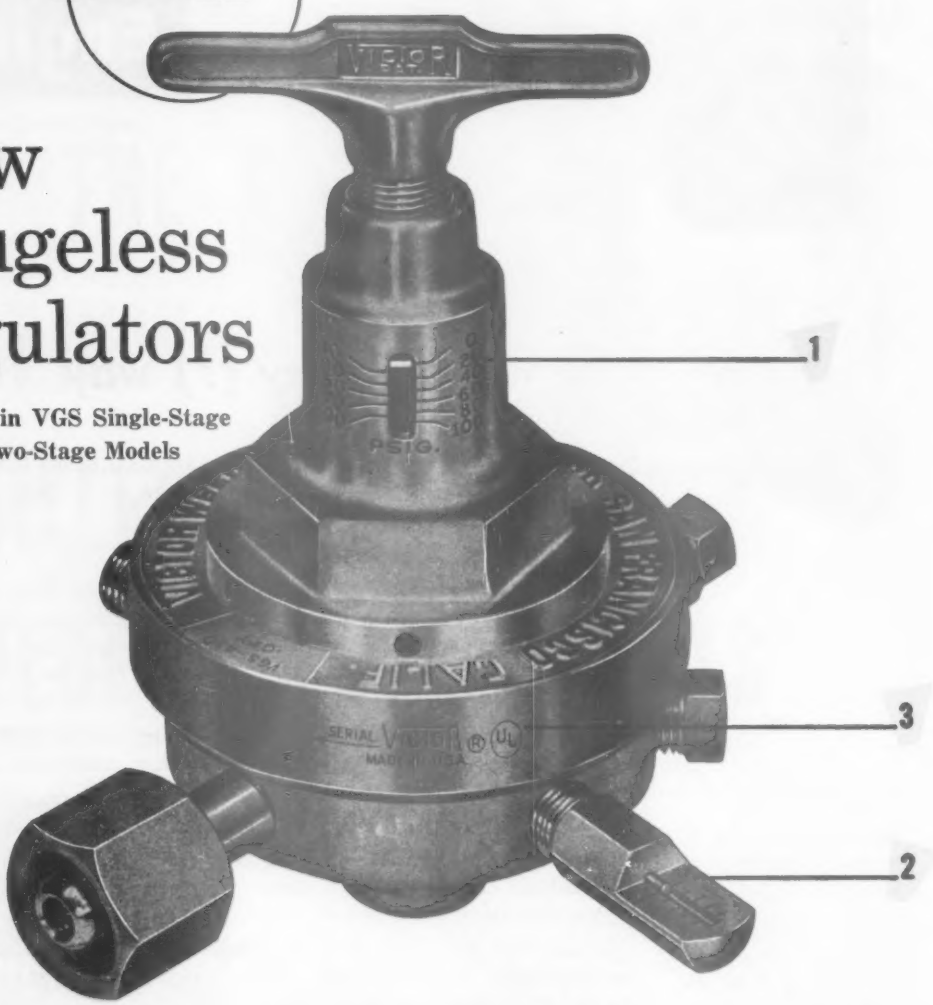

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- *Reduced costs*
- *Greater speeds*

by **Herman C. Phelps**

Plasma flame cutting of mild steel seen as competitive with oxy-fuel process

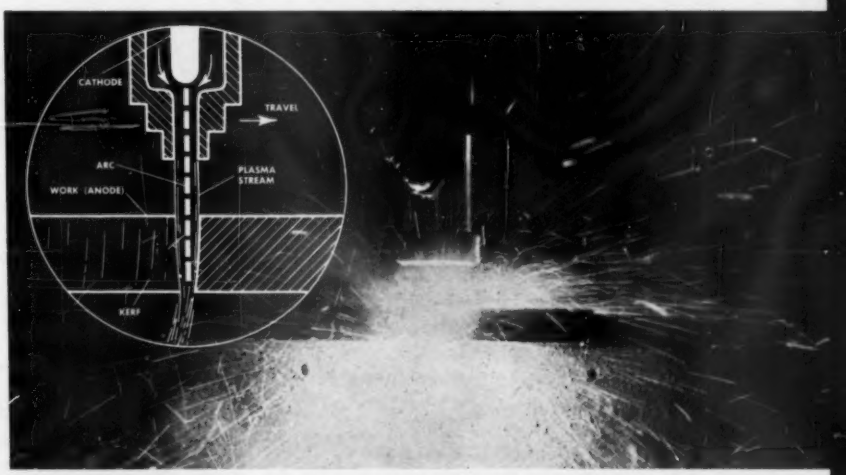
As 1961 MAKES its appearance, the oxy-fuel processes for cutting steel will be faced with a new competitor — the plasma flame cutter.

Composed of a plasma torch, control console and a d-c power source, this tool is now ready for delivery as an integrated package. According to the manufacturer, Thermal Dynamics Corp., Lebanon, N. H., final field testing will be completed sometime in January, 1961.

Utilizing the plasma flame principle (*see box*) the torch produces a high-velocity jet through arc heating of gas. The heated gas then expands as it leaves the torch nozzle, achieving velocities of thousands of feet per second.

These extreme velocities, combined with the arc's heating effects and the ultra-high (up to 60,000 F) temperatures of plasma, produce quality cuts in ferrous and non-ferrous metals at increased speeds and reduced costs.

[*Ed. note: The basic difference between the plasma flame cutter and the currently-used Tig cutting*



PLASMA flame cutter has arc transferred from torch (cathode) to the work (anode), the arc being contained within a high velocity plasma gas stream which provides necessary momentum to wash molten metal from kerf region.

Thermal Dynamics says . . .

"The advent of the plasma torch as a cutter has the manufacturers of pantograph devices seriously concerned," according to Thermal Dynamics' Product and Sales Manager, George A. Klasson. "Their customers are asking the question 'How are you planning to accommodate this new high speed device?' It is our feeling that these manufacturers will be forced to produce tools that will allow for higher speed shape cutting. This then, would allow fabricators to cut at higher speeds and improve the existing economic comparison between plasma and oxy-fuel cutters."

torch is in the method of arc stabilization. The plasma flame cutter employs a gas sheath stabilization whereas the Tig torch uses wall stabilization as explained in the boxed material. Another difference is that the plasma flame cutter can operate at higher voltages and powers, thereby enabling it to more easily achieve cuts on heavier sections.]

The temperature produced by the plasma flame indicated that it might be used to cut materials that, previously were difficult to cut or could not be cut at all (*e.g.*, stainless steel, aluminum, copper and its alloys, tungsten, molybdenum, etc.).

As for cutting of ferrous metals, a study of the plasma flame cutter versus oxy-natural gas cutting indicated that the former was economical in thicknesses up to and including 2½ in.

The study was made using gas costs and data developed during an investigation of possible use of plasma flame cutting on ferrous and non-ferrous scrap (*see table* 1). Based on figures supplied by the scrap processors, it was estimated that the equipment's write-off involved would take from one to two years.

However, these economies claimed for the plasma flame cutter relate principally to straight line cutting. Obviously, and in order to take advantage of the exceptionally high speeds indicated in table 2, the operation would have to involve a number of long, straight line cuts and generate a high use-factor for the tool.

In connection with shape cutting, most of these devices are limited to an approximate speed of 35 ipm. Thus, the plasma flame cutter's shape cutting speeds are limited (*see box above*) and its application restricted to stainless and other materials which cannot be cut with oxygen.

Further economies are anticipated by the manufacturer as the cutting operation becomes more sophisticated. These are based on taking better advantage of the temperatures involved, reducing kerf width and dross formation, improving kerf finish and making better use of the electrical power in the plasma process.

According to Thermal Dynamics' Product and Sales Manager George A. Klasson, four markets for the plasma flame cutter are expected:

(1) Basic producers of steel, aluminum, copper, etc., will find application for this cut-off device in terms of high-speed cut-off of hot and cold slabs and billets.

(2) Metals warehouses are already investigating and employing plasma flame cutters for straight line and shape cutting of ferrous and non-ferrous materials.

(3) Fabricators, faced with greater advances and use of materials such as aluminum, stainless, etc., must necessarily have a device to cut non-ferrous materials and, because of inherent economies, to cut and shape-cut ferrous materials.

(4) Automated industries will find use for the plasma flame cutter for high speed cut-off operations, hole piercing and metal removal.

"Quality of the cut face on prac-

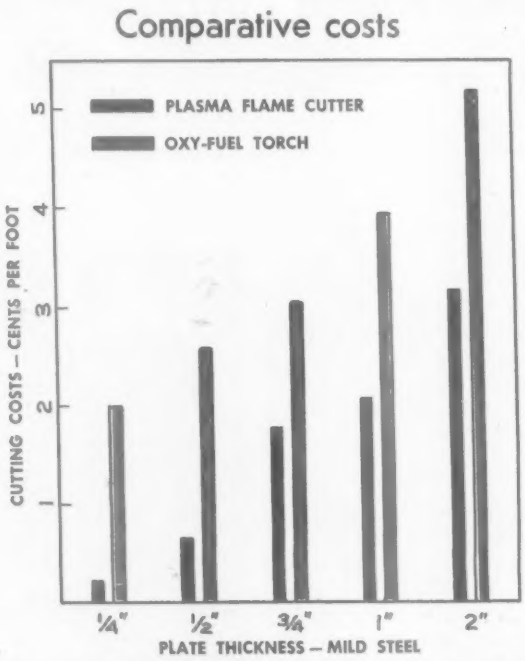
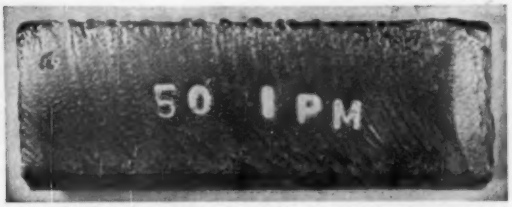


TABLE 1 — Although graph does not include overhead and amortization of equipment, in many cases the investment on equipment is realized in the first six months. The graph is based on the following costs: Oxygen — 0.50 cents per cu ft; Natural gas — 0.08 cents per cu ft; Nitrogen — 1.38 cents per cu ft; Hydrogen — 2.00 cents per cu ft; Power — 1.05 cents per kw; Labor — $2.00 per hour.



CUTS obtained from mild steel (left) and copper (right). The cutting speed for the 2-in. steel was 45 ipm, while that for the ¾-in. copper was 50 ipm as indicated. Other metals which have been cut with the plasma flame unit are stainless, aluminum, cast iron, brass, and nickel, as well as tungsten, molybdenum, tantalum, etc.

tically all materials is exceptionally good," Klasson further stated. "The surface is smoothed clean and ready for welding without any additional preparation.

"Practically speaking," he continued, "there is no dross formation. At first dross on the underside of the plate was a problem when cutting stainless from ¼ to ¾-in. thick, and particularly when shape-cutting. However, process development has alleviated this.

"In thinner (through ¾ in.) sections, plasma cuts produce bevels on both sides ranging in angle from a few degrees to as much as 30 deg, depending on the speed used. That is, the faster the travel speed, the more extreme the bevel.

"In many cases this bevel can prove to be a disadvantage. But the fact that a double bevel can be produced is a distinct advantage in plate preparation for welding. For 1-in. plate or thicker, cuts are straight."

The plasma cutter uses a series of cutting tips which increases in diameter as power requirements for cutting increase. Common cutting tip diameters might be 1/8, 3/16 and 1/4 in.

The ⅛-in. (orifice) diameter might be used on power levels up to 70 kw; the 3/16 from 50 to 150 kw and the ¼-in.-diameter tip for a power range from 125 to 250.

Kerf width generated is from 1½ to 2 times the orifice diameter. That is, a ⅛-in. cutting tip would produce a kerf width of 3/16 to ¼-in. wide.

Torch to work (stand-off) distance is not critical and can vary from ¼ to 1¼ in. without producing any adverse effects such as kerf width variation. This is important, considering that any cuts on a large flat surface probably would encounter extensive variation in the plate's surface.

Operation of the torch is not difficult. The electrode and cutting tip combination is factory inspected and requires no adjust-

What is plasma?

PLASMA IS THE FOURTH state of matter (the other three being solid, liquid and gaseous) and refers to the state of the gas used in a plasma flame torch.

The gas is raised to such high temperatures that its molecules break up and strip off some of the electrons from the atom, thus partially ionizing the gas. This ionized gas, or plasma, issues from the torch in a bright flame.

(A good example of a natural plasma is the sun. Consisting principally of hydrogen and helium, its gases are raised to extremely high temperatures. The sun's surface is estimated to be 10,000 F; with the plasma torch, temperatures six times greater can be obtained.)

There are two basic methods of plasma torch operation: non-transferred and transferred. In the former the arc strikes from the cathode to the anode (torch tip) never leaving the torch.

The latter method (as seen in the plasma flame cutter) has the arc striking from the cathode, passing through, but not touching, the torch nozzle, and then striking the work piece (anode) to complete the electrical circuit.

The high temperature is obtained by resistance heating of the gas by the arc in both methods mentioned. These temperatures are a function of nozzle passage length and geometry, gas flow rate, power levels used in the torch, and the type of gas or gas mixture employed.

Generally, the non-transferred method produces lower temperatures than the transferred method.

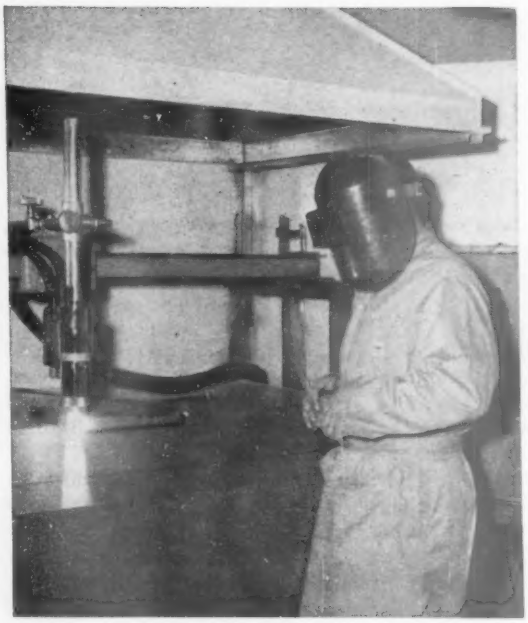
The arc in the plasma flame cutter is stabilized by a "gas sheath." The device is made to operate in such a manner as to produce an arc which is smaller in diameter than the actual torch orifice. A protective layer of gas is provided between orifice walls and the arc.

Other methods of stabilization are also possible. For example in "wall stabilization" (the method used in Tig cutting) the arc apparently fills the nozzle completely from wall to wall with arc and gas completely intermingled.

Any number of gases can be used in the torch: argon, nitrogen, hydrogen, helium, air and various other mixtures of gases. In the case of the plasma flame cutter, however, either a mixture of argon-hydrogen or nitrogen-hydrogen is used.

Conventional d-c welders using straight polarity were used in the beginning as power sources, *i.e.*, electrode is negative, and workpiece positive.

Torch ratings or process power levels are referred to in terms of kilowatts. Power is measured as the product of the operating voltage times the operating current. Range of power commonly being used now includes power levels up to 200 kw.



OPERATION of the plasma flame cutter is not difficult. Once gas flow rates and power levels are set, operation reduces to a start-stop function.

ment, alignment or grinding. Once the gas flow rates and power levels are set, equipment operation reduces to a start-stop function.

There is no preheat time involved and since the operator cannot leave the manual torch with the arc operating, the gas-consuming practice of leaving a lighted oxy-fuel torch is eliminated.

The plasma cutter can also be used for beveled cutting and must be given the same consideration for maintaining the stand-off distance as applies to present practice with oxy-fuel torches. (At present the maximum is 5 in. on both ferrous and non-ferrous materials.)

Where plate can be stacked in intimate contact, square-faced, high-quality stack cuts can be made. And since the cutter will pierce any thickness it can cut. (special procedure for thickness over 1 in. are required), the cutting process can be started without a starting hole or being presented to an edge. The technique with automatic cutting is to start the carriage first and then establish the arc.

The plasma flame cutter has a mounting bracket which allows for direct substitution for oxy-fuel torches on existing shape-cutting devises. Starting and stopping can be automated by incorporation of simple limit switches.

"Normally consumed replaceable parts such as the cutting tip will be priced in the approximate range of existing oxy-fuel cutting tips. Properly applied, cutting tip life should be far greater than present oxy-fuel cutting tips," Klasson said.

"This is partially due to the stand-off distance not being as critical and, hence, the tips are not as sensitive to splash when piercing and slag protruding above the surface plate. The electrode outlasts many tips."

The plasma cutter has a capacity far beyond 200 kw. Considering that perhaps 80 to 90% of the cutting employed today is on material thicknesses 1½ in. or less, and power requirements for making such cuts are not much more than 125 kw, more than ample capacity has been provided.

Safety considerations should be made for radiated energy and possible development of toxic fumes. The former is alleviated by providing proper eye, face and body protection as in arc welding. For the latter, adequate ventilation should be provided.

Other features of the plasma flame cutter include:

On thinner sections through ⅝-in. thick a tolerance of 1/16 in. can be held. On heavier sections, tolerances range between 1/16 and ⅛ in.

Practically speaking, the plasma cutter can cut any material known that is an electrical conductor.

The primary gases used are nitrogen and argon mixed with 10 to 35% hydrogen.

Cutting speeds

Plate Thickness	PLASMA FLAME CUTTER			OXY-ACETYLENE TORCH		
	Cutting Speed Inches/Min.	KW	Gas Flow SCFH	Cutting Speed Inches/Min.	Oxygen Flow SCFH	Acetylene Flow SCFH
¼"	525	115	240	26	70	14
½"	200	130	300	22	100	18
¾"	100	130	230	20	120	18
1"	80	130	230	18	130	18
1½"	50	150	230	16	170	25
2"	40	150	250	13	230	25
3"	20	210	250	10	270	32

TABLE 2 — Plasma flame cutter speeds are correlated with maximum recommended values for oxyacetylene cutting. Values for the plasma cutter are not maximum, but are limited by speed of mechanisms and available power. Relatively higher gas flows associated with thinner plates are due to high transverse speeds.

A total of 1.4 million Mig spot welds were required to assemble the stainless steel liners for four identical wind tunnel sections at U. S. Steel Corp.'s American Bridge Div., at Orange, Tex.

Mig, submerged-arc join wind tunnel parts

by S. J. Buell
Linde Co.

HEAVY-DUTY WIND TUNNELS for supersonic testing of airplane designs for the Air Force must withstand high ranges of air pressure, turbulence and frictional heat.

Stainless steel can provide these qualities; however, cost considerations have led to designs using high-tensile steel for the structural shell, with only a thin stainless steel liner.

Chief problem in fabricating the liner: it must be smooth, for low resistance to supersonic air flow, yet must withstand pressures up to 500 psi. Since only one side of the liner is accessible for welding, resistance spot welding, which requires access to both sides of the joint, is unsuitable.

Mig spot welding, an ideal process for welding stainless to high-tensile steel, requires access to only one side of the joint to achieve fully-penetrated spot welds — and the metal surface remains smooth.

American Bridge Division of U. S. Steel Corp., Orange, Tex., has assembled four air receiver vessels — each 100-ft long and 11½-ft in diameter — for wind tunnel sections, using multi-power submerged-arc welding and Mig spot welding.

Two welding heads, manufactured by Linde Co., New York City, and mounted on a boom, were to butt weld 1⅝-in. A-212B steel plate sections to form the vessel shell. The 70-deg, double-bevel joints incorporated a ¾-in. land and were ground for tight fit. Seams were preheated to 300 F prior to welding.

Four root passes were made at 6 ipm, using a single wire at 475 amp and 36 volts a-c. Seven cover passes at 15 ipm followed, with two Scott-connected a-c power sources providing 700 amp to the lead wire and 550 amp to the trailing wire at 36 volts a-c.

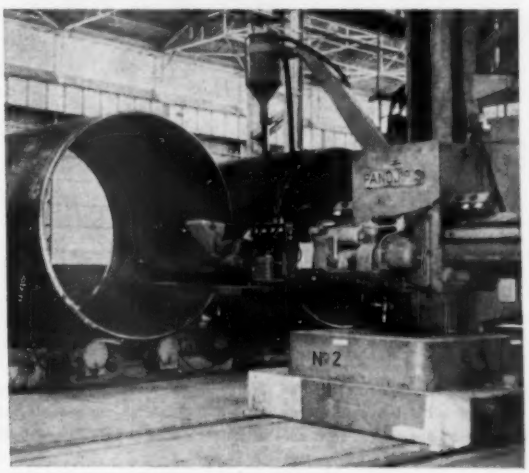
Completed vessel shells were then sand-blasted on the inside to remove scale and rust. Type 308 stainless steel sheets, each 4- by 9-ft and 7/64-in.-thick, were used to line the vessels. Sheets were lightly spot-welded into position until fitting was completed.

Inside the vessel head sections, heating was required to eliminate moisture condensation. Once all the stainless steel sheets were in place, the seams were taped to keep out dirt.

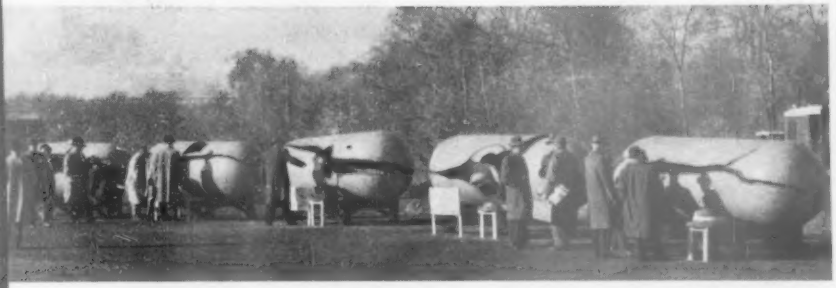
Final installation of the stainless steel liner was accomplished by Mig spot welding on 1-in. by 1½-in. centers. Approximately 1.4 million Mig spot welds, using 12,000 lb of stainless steel wire, were needed to line the four vessels. Welding speed averaged four spot welds per minute per man.

The completed lining was pressure-tested at 500 psi, followed by vacuum testing with soap suds. Acceptance rate was extremely high: 99.5% of the spot welds passed both tests.

In a final destructive test on a cut-out section of the vessel, between 2,275 and 2,400 psi were required before failure occurred between the vessel and the spot-welded liner.



TWO submerged-arc welding heads, mounted on automatic boom fixture, fabricate wind tunnel sections by butt welding 1⅝-in. high-tensile steel plate.



SOME of the 300 persons attending the test demonstrations inspect previously burst-tested cryogenic vessels. Below, pressure crack receives a closer look from Inco's F. L. LaQue, vice president, development and research.

Welded nickel steel vessels withstand pressure, impact without stress relief

PRESSURE VESSELS of nickel steel proved themselves more than adequate for cryogenic service in the as-welded condition during a recent two-day demonstration.

The material: quenched and tempered 9% nickel steel.

The proof: burst and impact tests well in excess of probable service conditions.

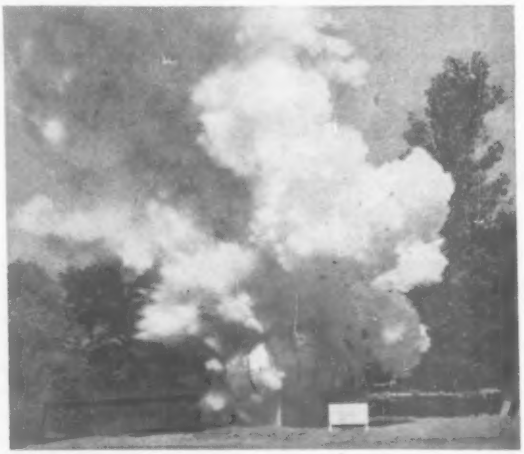
The tests were conducted at United States Steel Corp.'s Fairless Hills, Pa., plant in cooperation with The International Nickel Co., Inc., and Chicago Bridge and Iron Co. Some 300 representatives of government, industry and code regulatory groups, as well as WELDING ENGINEER, attended the demonstration, "Operation Cryogenics."

First developed by Inco 15 years ago, 9% nickel steel was and is still being used for welded vessels constructed under the Pressure Vessel Code for service down to –320 F *if stress relieved.*

Under the code's specifications a double-normalizing treatment (1,650 and 1,450 F) and a tempering treatment (1,025 to 1,085 F) were required for low-temperature vessels fabricated from the 9% nickel steel.

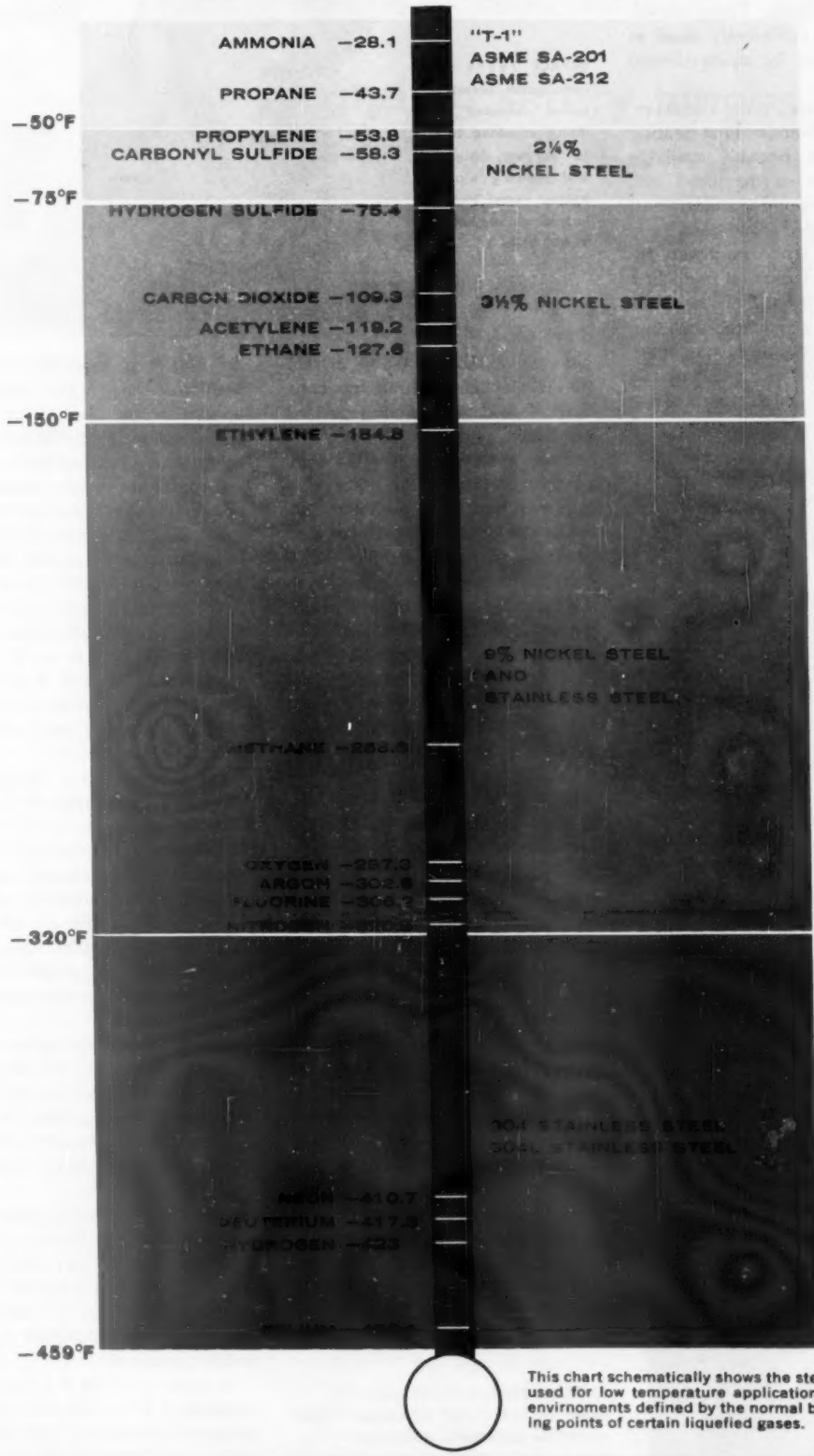
Because commercial quenching facilities for plates were limited at that time, emphasis was placed on developing a steel in which good low-temperature properties could

ENGINEERS make final checks as 9% nickel steel pressure vessel is filled with liquid nitrogen at —320 F. After personnel and equipment are moved to a safe distance, vessel is pressurized with additional liquid nitrogen until it bursts.



CYLINDRICAL pressure vessel filled with liquid nitrogen finally rips open but does not shatter under a load approximately six times the design stress of similar vessels now in use. Fragments shown are pieces of insulating material.

Steels For Low Temperature Use



This chart schematically shows the steels used for low temperature application in envirnoments defined by the normal boiling points of certain liquefied gases.

be obtained by normalizing.

About 200 such vessels have been built for low-temperature service starting with a liquid oxygen unit in 1952. These vessels have all been sufficiently small so that they could be stress-relieved in the shop.

In the mean time, however, modern continuous heat-treating facilities have become available for production of quenched and tempered plates under uniform and closely controlled conditions.

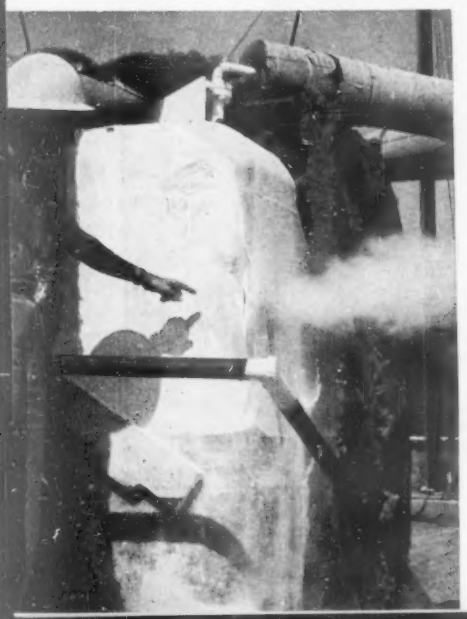
Laboratory tests conducted by U. S. Steel and Inco on quenched and tempered 9% nickel steel indicated that this material exhibits low-temperature notch toughness equal to or superior to that of the currently used double-normalized and tempered material.

Tensile strength of the two differently treated steels are about the same. However, yield strength of the quenched and tempered material is somewhat higher.

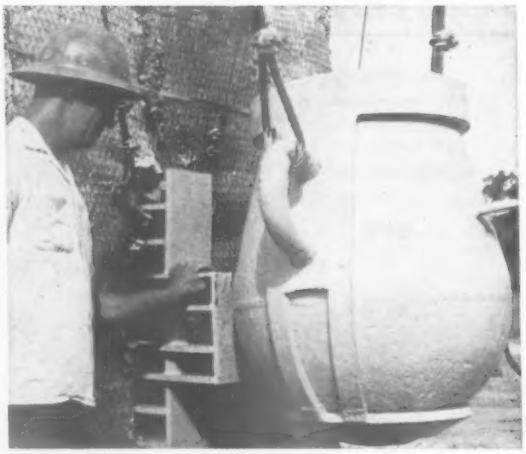
Significant economies are anticipated through use of the shorter quench and temper treatment, and through elimination of all stress relief treatments which the tests proved unnecessary.

Choice of a particular material for low-temperature or cryogenic application depends on the metal's toughness at service temperatures approximating the particular gas' boiling point, (*see data sheet on preceeding page*).

A second and equally important consideration is the relatively high cost of low-temperature metals,



ENGINEER points to ductile rupture in corner of nickel steel rectangular vessel which was subjected to a series of impacts with a 4,340-lb wrecking ball.



IMPACT tests on rectangular pressure vessel consisted of lifting wrecking ball to varying heights and swinging it against vessel. Heaviest blows exceeded 82,000 ft-lb.

not only initially but also in relation to specialized requirements for their fabrication, treatment and inspection.

Thus, costs can be further trimmed by specifying the exact alloy steel required for a particular job.

On the first day of the testing program, a 6,800 lb 9% nickel steel rectangular vessel, similar to the type used for shipboard transportation of liquified gas, was filled with liquid nitrogen and subjected at −320 F to severe shock by a 4,340 lb wrecking ball. It was tested with and without pressure under repeated blows exceeding 82,000 ft-lb.

The second vessel, similar to land-based storage and transportation types, was burst-tested the next day. Measuring 4 ft in diameter and 13 ft in overall length, the cylindrical vessel was also filled with liquid nitrogen and then pressurized to failure at —320 F. The stresses created were approximately six times greater than the design stress of such low-temperature vessels.

Cryogenic storage is becoming more important to industry because of its economy and safety as opposed to gas storage. An example was cited by Chicago Bridge and Iron Director John T. Horton.

To store 25 million cu ft of oxygen in gaseous form under a pressure of six atmospheres (approximately 73.3 psig), a spherical vessel 200 ft in diameter would be needed. Using T-1 steel, the sphere would be about 1½-in. thick and weigh 2,000 tons. Cost: more than $1.25 million.

In addition, at six atmospheres, the sphere would contain compression energy in excess of 25 million kilogram calories or the explosive equivalent of 15,000 lb of TNT.

On the other hand, a liquid oxygen container holding the equivalent of 25 million cu ft of gas would be only 38 ft 9 in. in diameter, have a maximum thickness of ¼-in. 9% nickel steel, and weigh some 25 tons.

(In gaseous form, oxygen has 862 times the volume of its liquid counterpart).

An outer sphere of carbon steel 8-ft larger in diameter adds 75 tons; insulating material, 45 tons, for a total weight of 145 tons. Cost: about $100,000. There is no compression energy since it operates at atmospheric pressure.

The test vessels were welded with Inco Weld "A" electrodes, which are used to join dissimilar metals and have a broader range of application. (See *Welding of dissimilar metals,* WE, Mid-June, 1959, p. 5).

At first plate edges were preheated to 100 F. During fabrication, however, a more stable arc was obtained over a greater length of the electrode by preheating to 200 F and using a slightly reduced welding current.

According to CB & I engineers, welding of 9% nickel steel requires no special positioning and the test tanks were field welded.

by Ralph N. S. Merritt*
Former Safety Committee Chairman
Grinding Wheel Institute

Grinding safety hinges on following the rules

THE PRIME REASON FOR SAFETY is the protection of the individual worker.

The grinding wheel manufacturer and the grinding machine manufacturer fulfill their responsibilities in this respect. But the grinding wheel user is also a very important link in the safety chain, and his responsibilities and duties are many.

On receipt of a shipment, grinding wheels must be inspected for any in-transit damage. Each wheel must be carefully lifted from the container and inspected visually for cracks or other defects.

To detect possible non-visible cracks, a ring test should be conducted. A sound wheel will give a clear, mechanical pitch if properly tapped with a non-metallic implement like a wooden screwdriver handle. This test should be repeated again when mounting wheels.

Suitable safe storage facilities in a dry place should be provided until wheels are to be used. Racks for storing straight wheels are recommended. Wheel specifications should be plainly marked on the rack and the rack should be subdivided to minimize wheel handling during selection.

Thin organic wheels should be stacked on flat surfaces to prevent warpage. If good storage facilities are not available, grinding wheels should be left in their original shipping containers.

Machine design is usually satisfactory as originally supplied. However, conditions of operation and use can introduce factors rendering the machine unsafe.

Approximately one-third of wheel failures can be directly traced to improper mounting, which introduces high internal strains in the wheel and is the largest, single cause of failure.

Several important factors must be constantly checked. The arbor or pilot must be correct to size within close limits to allow the wheel to slip over without excessive clearance or play and without forcing or wringing.

The weak zone in a rotating wheel is around the hole, thus mounting stresses must be applied as far from the hole as possible.

Flanges must be at least one-third the diameter of the wheel (if a small hole is used) and designed with proper thickness and relief to comply with the American Standards Association's safety code.

Flange design and condition are important. If flanges are not exactly the same diameter, with proper relief to apply pressure uniformly around the periphery of the flange, dangerous cross-bending strains are set up in the wheels. Resilient washers or blotters under suitable flanges will distribute the pressure safely.

Flanges should be checked frequently even when originally satisfactory. Warpage or excessive wear can concentrate dangerous mounting pressure too near the hole.

When wheels with large holes are used, extreme care must be taken with equipment and mounting procedure. All conditions of wheel strength and application of mounting pressure are more critical to prevent dangerous stresses from accumulating at the hole.

Each operator should know the exact speed of his wheel spindle to check against the maximum authorized speed of the wheel before mounting. This is particularly important when variable speed grinders are used or when changing wheels to different bonds or softer grades.

The new wheel should again be carefully examined for cracks or signs of damage from handling, and spindle speed must be within that authorized on the wheel.

The operator should examine the mounting spindle and flanges to be sure they are clean and not nicked or damaged. Flanges should be equal in diameter and large enough to meet minimum code requirements. They should also be properly recessed with flat bearing surfaces.

A single new blotter larger than the flange is used on each side of the wheel under the flange. The nut should be tightened snugly but not excessively, since driving pressure at speed is low and excessive tightening can strain the wheel and warp the flange, resulting in breakage.

All grinding operations should be fully guarded to protect the operator from accidental breakage. The ASA code provides complete technical details for suitable guards for all operations.

The operator should adjust and secure the guard before starting the machine. He should then stand out of line of the newly mounted wheel and start the machine, allowing it to operate a full minute before approaching the wheel. Breakages resulting from damaged wheels, mounting abuses or overspeed usually occur immediately after starting for the first time.

Now the operator need only observe the normal rules of grinding.

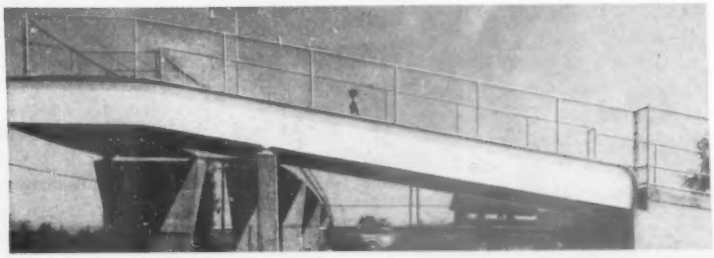
*Condensed from a paper presented at the 1960 National Safety Congress.

Welded-steel bridges . . .

WELDING and design joined to earn a first place award for Modrow Bridge in Cowlitz County, Wash.

HONORABLE mention in the movable bridges competition went to the welded Grant Line Canal Bridge in California.

ANOTHER welded bridge, College Avenue bridge in Appleton, Wisc., gained honorable mention.



KERN Avenue Pedestrian Overcrossing, MacFarland, Calif., took an honorable mention award in the competition.

FIRST prize honors also went to the welded Huasna River Bridge near Santa Maria, Calif.

STEEL BRIDGES AND BUILDINGS can be beautiful as well as functional.

Recognizing this fact, the American Institute of Steel Construction, Inc., New York City, has presented awards of excellence in recognition of outstanding beauty to seven welded bridges and five welded buildings.

In a nationwide competition, held this year for the first time, the Institute recognized aesthetic contributions to design in steel buildings by presenting 12 awards to buildings "best built with steel or best illustrating the aesthetic use of steel." Five of these awards went to welded buildings.

In a similiar national contest, now in its 32nd year, 15 awards were presented to bridges which a jury of four architects and an engineer felt to be the most beautiful opened to traffic in the United States during the previous year. Seven of these bridges were welded.

Structures in the building design competition ranged in size from a private house framed with exposed welded structural steel to a welded high school gymnasium.

CHURCH of Our Saviour, Baltimore, earned an Architectural Award of Excellence with this welded steel design.

. . . . . buildings win awards

Welded buildings receiving Architectural Awards of Excellence were: the American Trust Co., San Francisco; St. Ann's Catholic Church, Midland, Tex.; Bartlett Mountain Retreat Cabin, Huntington Lake, Calif.; Bloomington High School Gymnasium, Bloomington, Ill.; and Church of Our Saviour, Baltimore, Md.

According to M. G. Gaskin, chairman of the AISC Committee on Awards, the building design awards are given to honor architects who recognize aesthetic, practical and economic uses of structural steel in buildings; the prize bridge awards, considered primarily on the basis of relation of bridge design to setting, are given to honor engineers.

The bridge design contest is divided into four classifications, with size, cost and operating conditions determining what class bridges enter.

The prize winning bridge in the Class II division for bridges with fixed spans under 400 ft and costing more than $500,000 went to the Huasna River Bridge on Route 166, 10 miles northeast of Santa Maria, Calif. This welded bridge has 170-ft long girders which were shipped to the site in two pieces where one field weld was made in each before it was lifted into place. All connections, cross frames and laterial bracing were welded.

The prize winning bridge in the class III division for bridges with spans under 400 ft and costing less than $500,000 went to the Modrow Bridge in Cowlitz County, Wash. The jury called this welded bridge "the most imaginative and sensitive bridge in the competition."

A first honorable mention winner, the all-welded College Avenue Bridge in Appleton, Wis., contains 400 tons of structural carbon steel and 352 tons of structural low-alloy steel.

Another honorable mention winner was the all-welded Kern Avenue Pedestrian Overcrossing in MacFarland, Calif. Other welded bridges which received honorable mention were the Grant Line Canal Bridge, between Stockton and Tracy, Calif., and the Truckee River Bridge, 13 miles northeast of Truckee, Calif.

ST. ANN's Catholic Church, Midland, Tex., featured welding and design to win an award of excellence.

AMERICAN Trust Co., San Francisco, was another welded steel building to win an award.

BLOOMINGTON High School Gymnasium, Bloomington, Ill., gained an award with this use of welded design.

Safety
everywhere
. . . all the time

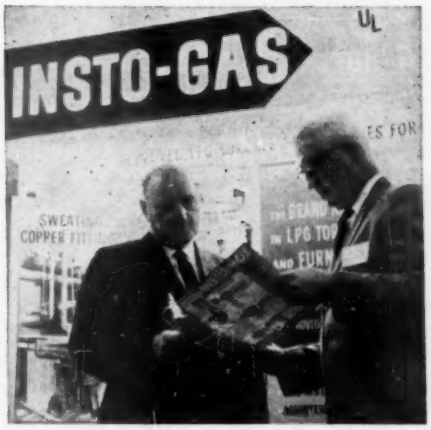
Safety congress draws

AN ESTIMATED 12,000 persons attended the 48th annual National Safety Congress and Exposition held recently in eight of Chicago's downtown hotels.

Some 867 speakers were presented at the various sessions during the five-day meeting, while approximately 195 exhibitors (see photos) displayed the latest equipment and services designed to carry out the theme for this year, "Safety everywhere, all the time."

Speaking at one of the luncheon meetings, Edgar B. Speer, administrative vice president (central operations) of United States Steel Corp. stated that safety morale of an industrial plant depends on the activities and attitudes of its management.

Further defining management's role, he said, "If at any point . . .



and exposition 12,000

there is a tendency to slough off safety responsibilities . . . that man can blame no one but himself if the men who report to him are less enthusiastic about safety than he thinks they should be.

"Every level of management takes its cue . . . from the activities and attitudes of those above."

In another talk, former Grinding Wheel Institute Chairman Ralph Merritt detailed the nature and safe use of grinding wheels, as well as the responsibilities accruing to manufacturers and operators (*see page* 41).

"Grinding is one of the safest operations in the field of stock removal," he said. "The hundreds of grinding wheels daily in use with only occasional accidental breakage present a remarkable record of safety."

Tig welded insert ring helps increase pipe quality

by C. H. Voelker
Chief Welding Engineer
M. W. Kellogg Co.

WHEN PIPE BUTT WELDS are needed in lines designed for severe and cyclic services, special techniques are required to produce extra high-quality welds.

Using hydrogen instead of cellulosic electrodes can improve the weld out of all pipe welds, but the problem in making high-quality welded pipe joints is how best to make the root weld.

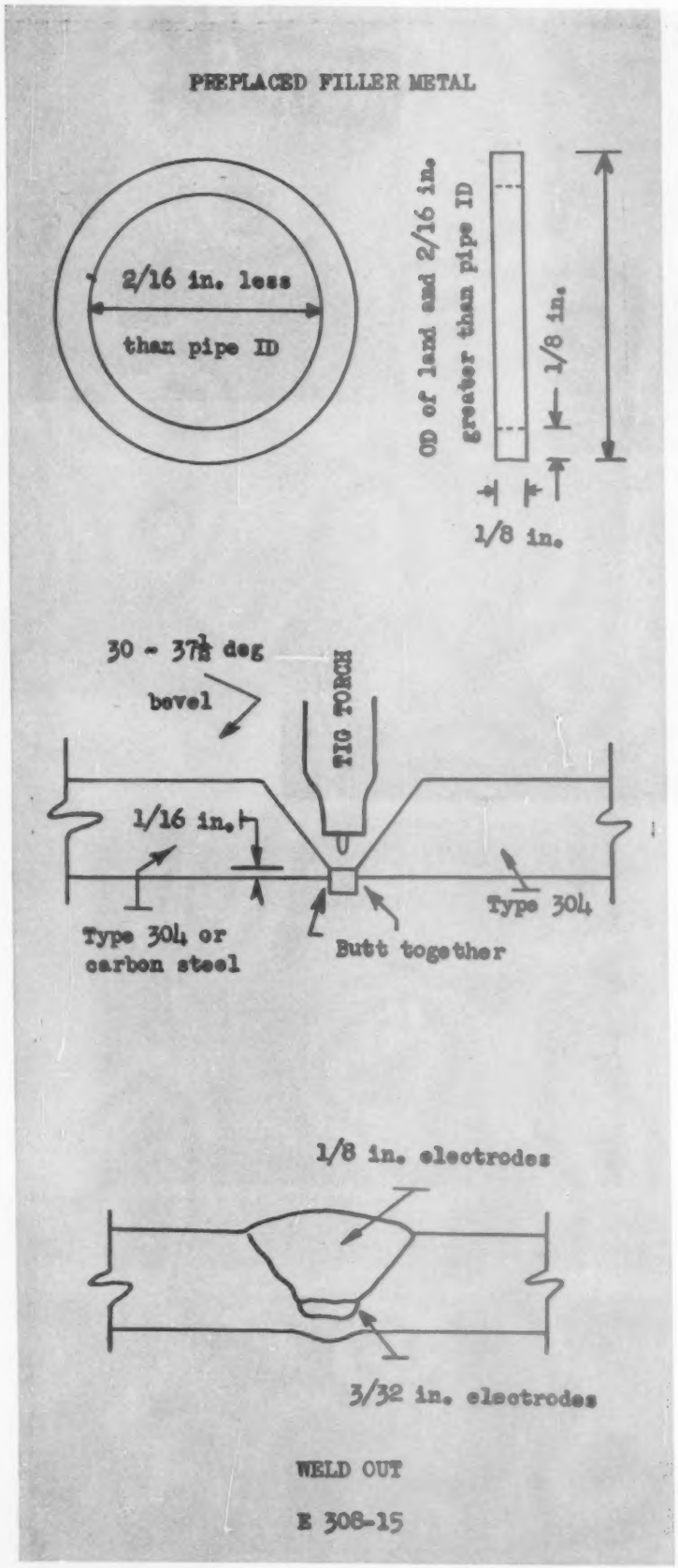
One technique is to use preplaced filler metal, and the latest and perhaps most practical shape it can take is the K-Ring, developed by M. W. Kellogg Co., New York City.

For a number of years, ASTM's committee on nondestructive testing has been considering a penetrameter 1/100th of the weld thickness, with hole diameters 1/100, 2/100 and 4/100 the weld thickness.

Whether or not this new standard is added to ASTM specifications, creation of such quality welds is a problem many fabricators are likely to face in the near future — particularly when fabricating pipe for severe service.

An equivalent penetrameter of 1% suggests a better weld than the usual manual metal-arc process will yield. For severe-pressure piping services, designing for the highest quality welds seems a practical objective since welds of average quality may be insufficient or dangerous for severe services and over-conservative and too expensive for mild service.

If the specified weld were in



the next lower quality class (2% equivalent penetrameter sensitivity) either an oxyacetylene root with open land or a butted land, Tig root would probably suffice.

But with an objective of 1% equivalent penetrameter sensitivity, additional control is necessary to yield an improved root condition in single-welded pipe joints. This extra control can be gained by use of preplaced filler metal.

These fillers are similar to the formed silver or soft solder inserts familiar in induction techniques. A filler metal ring can be placed between pipe ends machined to accommodate it.

Before the K-Ring was developed, however, two other methods were used to create high-quality root welds.

The first involved a single vee bevel. When using this bevel, Tig welding can be used for severe service without employing preplaced filler metal, provided the vee is widened to a 90 deg angle and the pipe lands are butted.

These welds, however, showed enough irregularity so as to be frequently rejected by radiographic inspections, and their inside surfaces were difficult to control.

The second method involved spacing 90-deg beveled pipe with lands 5/32 in. apart and then feeding in straight ⅛-in.-diameter wire. The wire was first fused to form a ring, then welding proceeded in the upward direction.

This technique, too, sometimes resulted in an irregular ID and in other cases, in a lack of proper fusion. Difficulties developed because the weldor's attention was divided between forming the ring and welding it.

With preplaced filler metal a more uniform weld contour could be obtained and when weldors are properly trained, high-quality welds free from crevices and cracks could result.

Various shapes for the K-Ring were tested and a square cross-section ring was finally chosen. This shape can be used in both shop and field welding.

One of the chief advantages of the K-Ring is that when placed in the groove, it does not cover the lands to be welded.

While it is possible to make welds on rings which are laid outside the lands, the quality of such welds does not compare with either the 1% sensitivity desirable for severe cyclic services, or with ordinary Tig welds. These rings fail to increase weld quality because heat is played on the filler metal and not on the base metal.

Other advantages include: (1) adjustments for wall thinness can be inexpensively made; (2) field changes can be made easily and efficiently; (3) lack of fusion between pipe ID and the insert ring is automatically eliminated by the ring's geometry; (4) ring OD can be matched to that of the land; and (5) variations in machined ID's of tubes can be better tolerated, and when the ID is ground, rings are used without machining the ID.

With the K-Ring, however, care must be taken to assure that pipe is cut at 90 deg. It is easier and more economical to make this one cut in the field and use the K-Rings than to make a cut and match roundness and size of IDs.

For field welding of steel a 1/16-in. 2% thoriated tungsten electrode is used. Current has varied from 65 to 120 amp. Bead contour inside the pipe can be varied by adjusting the travel speed and the current.

If the weldor works on the cold side of the current range, less of the preplaced filler metal will be pulled up to the pipe ID. Hence, reinforcement on the ID will be larger, and will occur even when travel speeds exceed 3 ipm.

Conversely, ID reinforcement will be flatter if the weldor uses a hot arc and uses current on the higher side of the range. This greater degree of flattening also occurs with travel speeds under 3 ipm.

These differences permit the weldor to predetermine the shape of the reinforcement on the inside of the pipe. A concave appearance on the accessible side, for example, indicates a concave appearance on the inaccessible side. After one or two additional ordinary Tig layers, weld out is done by manual metal-arc welding. (*see below*).

Procedure for using insert ring

Root weld*

First pass, Tig (argon backup); no filler rod
- (a) Weld 7 o'clock to 4 o'clock
- (b) Weld 10 o'clock to 1 o'clock
- (c) Weld 4 o'clock to 1 o'clock
- (d) Weld 7 o'clock to 10 o'clock

Electrodes: 1/16-in. diameter, 2% thoriated tungsten, clean finish
Amp: 80 to 120
Speed: 3 ipm
Bare welding rod: 1/8-in.-diameter R308L
Argon shield: 11 cfh at 20 psi
Argon backup: 11 cfh at 20 psi
Tack ring: every inch both sides

Weld out

First manual metal-arc pass: 3/32-in.-diameter
Remaining layers: 1/8-in.-diameter
Electrodes: E308-15 for both sizes
Amp: for 3/32-in.-diameter electrodes—65-80
for 1/8-in.-diameter electrodes—90-110
Direction: upward in 5G position

Heat treatment

Preheat: none, interpass; 220 F maximum
Postheat: none

Inspection

Dye penetrant for root weld
Radiography: three 120 deg shots for each weld

**Note: Do not puddle or go back over root weld to an extent that weld ID is affected. Top of root pass should be slightly convex. A second Tig layer with R308L filler may be necessary.*

MODEL of *Achievement* is on case behind Leon C. Bibber, retired welding research engineer, who converted barge himself, is building the 80-ft vessel himself, and will sail it himself. This is third level of barge. Bedrooms are at fourth level. Housebarge Cocoon also has two sundecks.

A salute to initiative

80-ft welded yacht a do-it-yourself project? Yes!

by F. T. Tancula

PROBABLY ONE OF THE LARGEST do-it-yourself projects ever attempted — certainly the largest we have ever reported — is the construction of an 80-ft all-welded steel yacht.

The one-man shipbuilding enterprise is that of Leon C. Bibber, who retired about 18 months ago from United States Steel Corp. as chief research engineer, welding.

As remarkable as the fact that Bibber has designed and is building such a large craft by himself is the fact that his "shipyard" is a converted coal barge which also includes his living quarters. The housebarge *Cocoon*, permanently moored in the Allegheny River in Pittsburgh, is 175-ft long and has a 26-ft beam.

A large superstructure 160-ft long — in reality four high walls topped by a gabled roof — atop the barge was built by Bibber and shelters the whole operation. The steel hull of the barge becomes a big jig for construction of the steel yacht.

To be known as the *Achievement*, the 80-ft welded vessel will have a 19-ft beam, 5-ft draft, and will displace 120 long tons.

When the yacht is ready to be launched — Bibber hopes in less than three years — a floating crane will remove the end and some of the roof trusses, one end of the barge will be sunk, and the ship will be floated out into the river.

All machinery and equipment now housed on the barge and used to construct the *Achievement* will be placed aboard the latter before its launching. This same equipment will be used to maintain the yacht itself.

The machine and welding shop aboard the barge contains a 50-ton hydraulic press that can be converted into a punch press or shear; one air compressor, with two tanks; one a-c/d-c welder; an automatic flame-cutting machine; a vertical milling machine; lathe; grinder; and the usual accessory equipment, including holders, clamps, chipping hammers and grinding wheels.

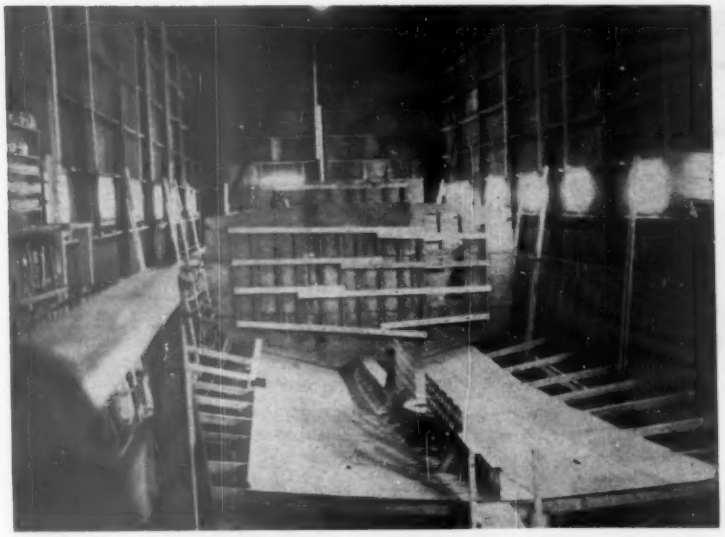
The neatness of this enclosed shipyard is a marvel. All air, power, fuel and similar lines run between the inner and outer bulkheads, with outlets at work areas around the periphery of the barge. All air hoses and welding leads are jacked in.

All plate on the *Achievement* is 3/16-in. 1008 low-carbon steel. Bibber is using E6011 electrodes, 3/32-in. diameter, to join the plate. Although the E6011 can be used on either a-c or d-c, most of the joints have been, and will be, made with d-c power.

About 70 tons of steel will go into the ship, and all of it will be welded manually.

Bibber uses oxypropane for cutting and grinds a double bevel on edges to be butt welded. Although such edge preparation is uncommon on thin plate, it helps elimin-

STIFFENERS are welded to 3/16-in. plate with E6011 electrodes. This work table is on lowest level, 18-in. above the water. Machine and welding shop is also on this level.



CONVERTED coal barge contains "shipyard" where welded yacht, *Achievement*, shown here in early stages of construction, is being built. Photo was taken from second level of barge, which at one end is four stories high. Two top levels contain living quarters.

ate warping by minimizing weld size. Another means he utilizes to prevent plate distortion is the wandering welding sequence.

The thin butt welds — one pass on either side — are made with a current of 60 amp at 23 volts. Fillets, employed in joining stiffeners to plate, normally are 1/8 in.

When finished, the *Achievement* will be powered by two 200-hp Diesel engines. A 300-amp generator welder driven by the main engines will also be added to present equipment. It will double as a battery charger.

The *Achievement* is a five compartment ship with four water-tight bulkheads. This degree of compartmentation is unusual in so small a boat, but will make her practically unsinkable.

She will be two decks high over her length, but at the point of the flying bridge it will be three decks high. The yacht is designed for two family living rather than for large weekend parties.

A rather unusual feature will be an automobile lift in the after compartment. This lift is capable of raising a full size automobile to the main deck. Sliding runways will guide the car ashore.

Two 13-ft boats will be carried, a sailing dinghy named *Minor Achievement*, and a motor dinghy named *Lesser Achievement*.

All wood trim and cabinet work will be installed after launching — by Bibber . . . of course. Designed for one-man operation, the *Achievement's* captain and crew will be Bibber.

He will take it down the Ohio River to the Mississippi and thence to the Gulf of Mexico and the Atlantic Ocean. He expects to ply the Eastern seaboard from New England down to the Caribbean.

This labor of love has been going on for 15 years — long before Bibber's retirement. He has been designing and planning acquisition of necessary equipment that long, although actual shipbuilding work began only seven months ago. He has made the barge his home for about four years.

Bibber comes by his shipbuilding and seafaring naturally. He is a native of Maine and holds a degree in naval architecture and marine engineering from the University of Michigan. He spent 25 years in the shipbuilding industry.

His career in welding has brought him many honors—among them the Lincoln Gold Metal in 1945, honorary membership in the American Welding Society in 1958, and election as an AWS district vice president.

But none will be as rewarding as the launching of the *Achievement* — truly an appropriate name.

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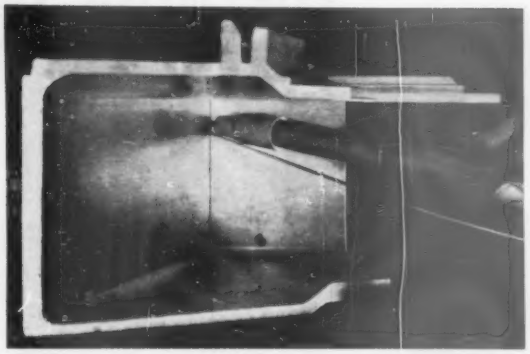

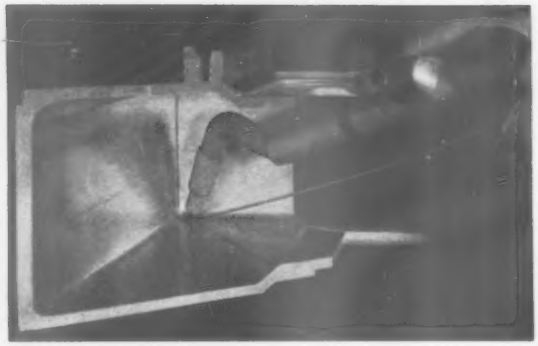

TELESCOPING feature of Tig torch (left) enables weldor to reach and weld cabinet corner. Adjusting head to duck-bill position (right) allows torch to reach under upper lip and weld lower cabinet corner.

by **Forde M. Simms**
and **John V. Warinsky**
Falstrom Co.
Passaic, N. J.

Controlled angle Tig torch simplifies cabinet welding

COMPACTNESS IS THE KEY to much of the work being done in the rocket and missile field.

This compactness extends even to the fabrication of electronic cabinets and consoles — where it presents difficulties in welding.

The problem in this case: to Tig weld recessed corners and areas and to maneuver the torch through restricted openings.

The solution: a controlled angle Tig torch.

A typical application of this flexible Tig welding torch, developed by Falstrom Co., is the fabrication of a magnesium-alloy cabinet.

Measuring 15 by 18 in. around its base and standing 24-in. high, the cabinet's bottom frame is fabricated from four pieces of ¼-in.-thick extruded magnesium. Side stock is ⅛-in. thick.

The base is formed by cutting the extruded pieces at 50 and 40 deg angles and then Tig welding them.

The immediate problem was to weld the inside corner seams. But since the access opening on one side is only 3½ in., standard Tig torches could not be used.

However, utilizing the flexible torch's telescoping feature, the corner is easily reached, and by adjusting the extended torch into a duck-bill position, the torch easily reaches under the upper lip to weld the lower corner.

Both top and bottom seams are welded with good visibility and minimum difficulty to the weldor.

SEAM welding of the inside edge of the angles required the flexible Tig torch to be bent a full 180 deg, impossible to do with existing equipment.

After the magnesium frame is set up on the base, the inside edge of the angles is seam welded by bending the torch 180 deg. The assembly is then stress relieved for three hours at 350 F.

Welding was done at 14-16 volts, 120 amps, a-c, high frequency using 25 cu ft of argon per hour and a continuous water flow. Filler metal was AZ31B in the following diameters: 1/16 in. for wire and 3/32 to ⅛ in. for rod.

The continuous flexibility of the torch head is obtained by inter-twining the two copper cooling water lines and the copper gas line. This rigid, yet flexible, core is brazed to the cooling head.

The entire assembly is then molded and bonded with neoprene. With this construction, the weldor has only to move the torch head to the desired angle without use of any tools.

ARC "MACHINING" ANY TOUGH-TO-CUT METAL ON-THE-JOB WITH NEW AC CHAMFERTRODE®

• Seven years ago, EUTECTIC's research conceived, developed and patented an exclusive process: "machining" metal anyplace with a blast from a DC electrode. Now, a brilliant follow-up to its DC forerunner... ChamferTrode AC-DC... brings AC shops and "field" outlets the advantages of cutting, gouging, chamfering any metal... No gasses, no air, no special holder or equipment. Truly universal, ChamferTrode AC-DC brings electrode "machining" to every weldor... on-the-job... anyplace in the world.

OTHER STRIKING FACTS . . . ChamferTrode AC-DC offers improved formulation terrific for stainless steels, hard metals, manganese and carbon steels, cast iron, copper alloys, monel. Tops on contaminated metals! Other features include • Lower burn-off rate • Excellent re-striking qualities for intermittent gouging; famous re-strikability further increased • Lower starting current; larger diameter electrodes may be used. With ChamferTrode AC-DC, no gasses or special equipment are needed.

SUMMING UP: ChamferTrode AC-DC permits you to go to the job with the electrode... instead of bringing the job to the machine. It represents one of the greatest advances in the state of the art of welding since Eutectic's original concept of cutting with an arc. Send the coupon below, now!

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Please send complete literature on ChamferTrode® AC-DC.

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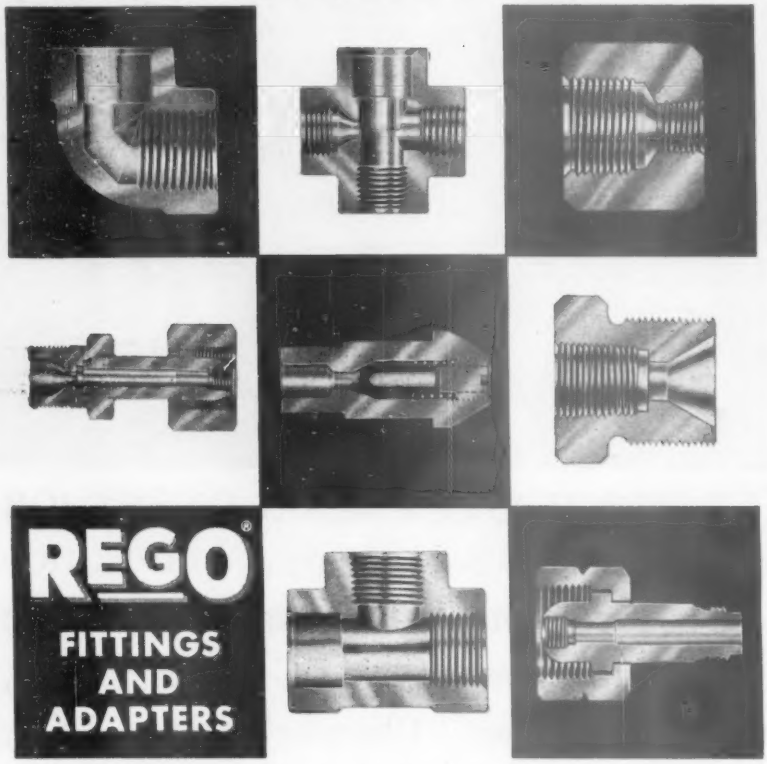
Originator of the Low Heat Input process... The ONLY welding alloy manufacturer in the world capable of producing welding rods and electrodes from virgin metals to finished products in ANY metal.

RegO...extra-heavy, high-quality fittings... for fluid handling...pressures to 3000 psi.



most complete line in the industry

From storage source to point-of-use, RegO fittings and adapters will meet all your high-pressure pipe connection requirements. All are of brass, forged or extruded, for pressures to 3000 psi. Precisely machined pipe threads conform to American National Taper Pipe Thread (Dry-seal Form), CGA, or socket connection standards. Elbows, tees, crosses, adapters, plugs, nipples, tailpieces, union connection nuts, coupling assemblies and flange unions are available in an exceptional variety of connection combinations. (Special combinations can also be arranged.)

All items are made in strict accord with industrial specifications, carefully cleaned for oxygen service.

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THE BASTIAN-BLESSING COMPANY
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Chicago 46, Illinois

BRAZING alloy is applied with glass dropper. Finished compressor turbine will have more than 60 brazed parts.

Close tolerances on turbine held by furnace brazing

UNUSUALLY CLOSE dimensional tolerances in a stainless steel compressor turbine are being achieved while simultaneously furnace brazing more than 60 separate parts.

The turbine, produced by The United Tool & Die Co., West Hartford, Conn., is a critical part in the air conditioning system on the B-58 Hustler bomber.

Brazing is performed by Wall Colmonoy Corp.'s Stainless Processing Division at Morrisville, Pa.

Among the compressor's components are nine main vanes, 18 exit guide vanes, 18 rib plates and 12 studs which are brazed into place in a pure dry-hydrogen furnace at 2,150 F. Vanes and rib plates are fabricated of AISI 347 stainless steel; studs are made of HS Spec 279 Type 2.

Typical of the close dimensional specification held in the turbine assembly are:

(1) Stud circle diameter, which is more than 5 1/4 in., is held to size within 0.002 in.

(2) Turbine assembly ID is held concentric within 0.005 in.

(3) Centerline of each stud is held square with the turbine assembly ID surface within 0.010 in.

The Linde Oxygen Converter provides a far greater oxygen supply in 1/7 the space and 237 lbs. less weight than compressed-gas containers.

All the oxygen needed in 1/7 the space

Five-position radiographs on Kodak Industrial X-ray Film, Type AA, check the integrity of the Heliarc girth welds on this oxygen converter manufactured by Linde Company, Division of Union Carbide Corporation.

A high-flying airplane can now carry its oxygen supply in a Linde converter that weighs 237 lbs. less than the usual jumbo-sized cylinder and occupies only 7.9 cu. ft.

In making a container to carry liquid oxygen, Linde Company was faced with the problem of holding extremely high pressures and low temperatures. The problem was solved by using an inner and outer sphere with high vacuum as insulation in between. The seams are Heliarc welded and each proved sound by radiography with Kodak Industrial X-ray Film. With this assurance Linde has extended its 90-day guarantee on the vacuum insulation to a full year.

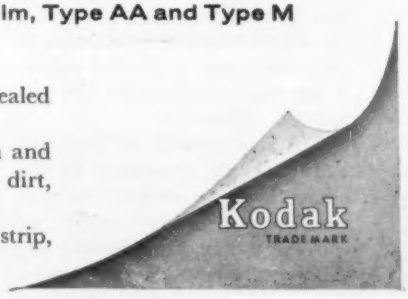
This is another example of the way radiography helps to further the use of the welding process, and increase the value of welded products.

X-ray testing can save your company time and money. Consult an x-ray dealer or write us for a Kodak Technical Representative to call.

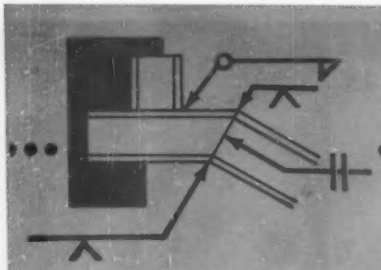
X-ray Division **EASTMAN KODAK COMPANY** Rochester 4, N.Y.

Now in the NEW Ready Pack... Kodak Industrial X-ray Film, Type AA and Type M

- No darkroom loading—each sheet sealed in a light-tight envelope.
- Just place Ready Pack in position and expose—film protected from dust, dirt, light and moisture.
- In the darkroom—just pull the rip strip, remove film and process.



For more facts Circle No. 179 on Reader Service Card



the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Stainless steel electrode coatings identified

Question:

Do stainless steel electrode coatings vary for each type and manufacturer, and if so, what are they?

Answer:

All stainless steel electrodes, regardless of their manufacturing source or analysis, are coated with one of two fundamental types of coating — lime or titania.

These two types differ considerably in operating characteristics, yet both are capable of yielding excellent weld metal.

The titania coating is usually considered the more desirable from an operating standpoint. It can be identified by the following characteristics:

The puddle is small; the molten slag moves rapidly to the back half of the puddle and has very little tendency to interfere with the welding operation.

After solidification, the slag is hard, glassy and usually black. It is easily and cleanly removed except in a tight vee. A positioned fillet bead is flat to concave, and all beads are even in width and have a smooth, lightly rippled surface.

This type of coating produces the best appearing weld and a bead that requires a minimum of polishing where a finished surface is required, according to The McKay Co., Pittsburgh.

The lime coating, on the other hand, may be recognized by the larger, hotter appearing arc puddle. The slag freezes rapidly and aids the weldor in controlling the deposit when welding vertically. Hence, this type of coating is generally considered best for vertical operations.

The slag, when cooled, is more porous and crumbly and is removed easily under most conditions. The positioned fillet bead tends to be convex in shape, and all beads are rougher and less regular in width than those produced by titania coated electrodes.

Question:

We are having problems welding Ledloy steel. Could you offer any solution?

Answer:

Since you do not specify the problems you are encountering in the welding of this leaded steel, it is difficult to offer a solution.

According to the manufacturer of this steel, Inland Steel Co., Chicago, there is such a low addition of lead (0.15 to 0.35%) and it is so well dispersed that there should be no harmful effect on welding operations.

This distribution of lead has no appreciable beneficial or harmful effect on the mechanical properties of the steel because these properties are determined by the basic chemical analysis of the particular leaded steel. Therefore, leaded steels can be torch-cut, welded, brazed or heat-treated in the same manner as the basic steel.

Question:

What causes small, transverse cracks when welding N-A-Xtra steel? I am using a 3/16*-in.-diameter* E-11018 *electrode to join preheated* 1*-in.-thick material to* ⅜*-in.-thick material.*

Answer:

The steel you are welding is a high yield strength type, which is quenched and tempered, and has a high hardenability. Alloy Rods Co., York, Pa., states that such steels can be successfully welded only with low-hydrogen electrodes which may or may not contain iron powder.

Hence, the E-11018 electrode selected for this application is correct since it is classed as a low-hydrogen, iron-powder type. These electrodes have been made by the manufacturers to have an extremely low hydrogen content.

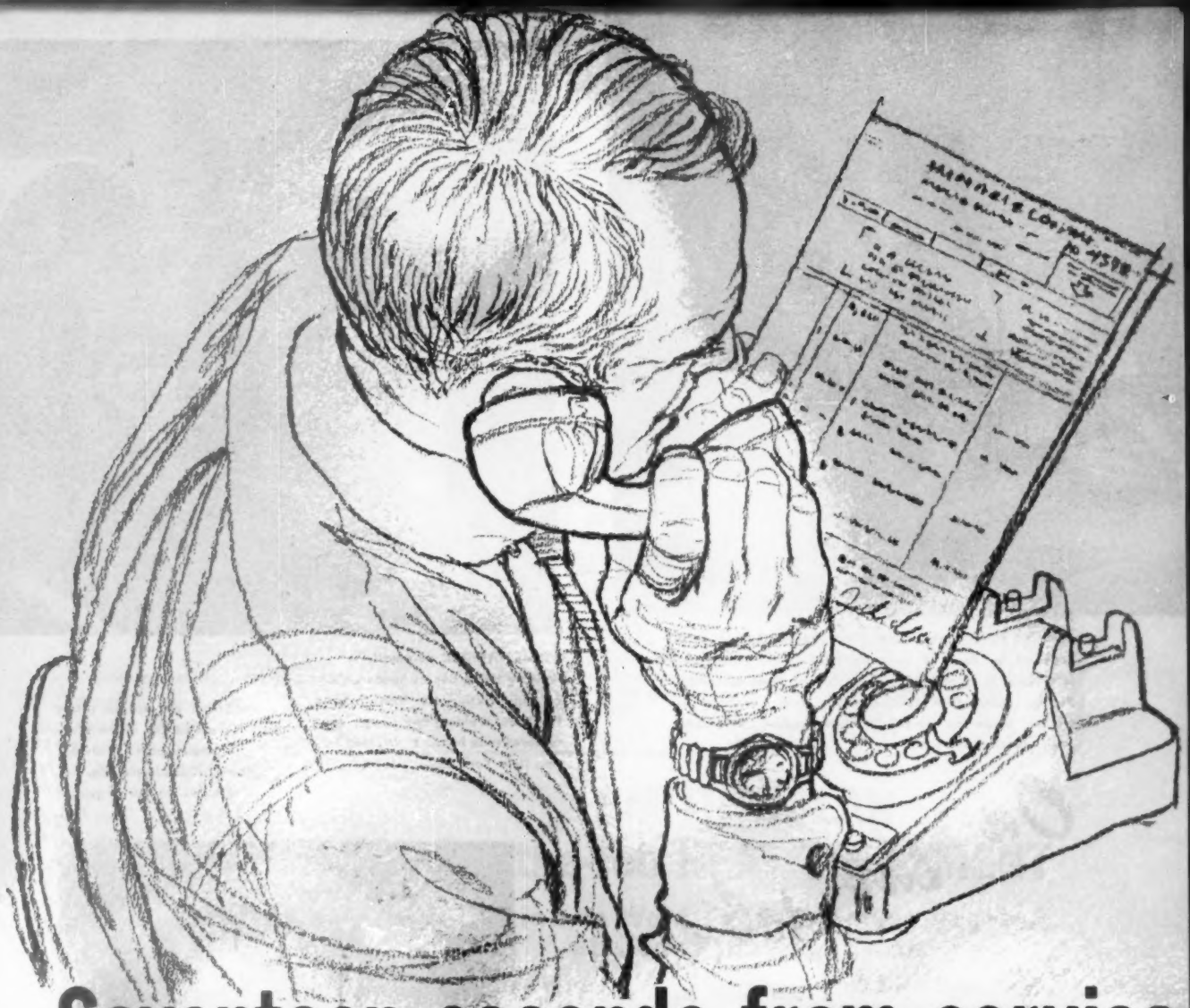
The transverse cracking you have described is typical of that encountered with highly restrained joints in such steels when the hydrogen content of the welding atmosphere is on the high side.

Usually the cracks are caused by the fact that the electrode coatings have been allowed to reabsorb water from the atmosphere (by too-long an exposure in air before use) or by condensation of moisture on the steel plate to be welded.

Correction is made by placing the electrode in a drying oven at a temperature of 225 F or higher immediately after removing it from the hermetically sealed container and until just prior to use. The plate to be welded should also be preheated to a temperature between 225 and 250 F.

The plate material should, of course, be cleaned of any oil, paint or greases prior to welding since these would also be a source of the troublesome hydrogen.

For more facts Circle No. 180 on Reader Service Card →



Seventeen seconds from service

Whatever the job . . . welding, cutting, brazing, or metal conditioning . . . you are only seventeen seconds from service when you call your nearby NCG dealer. Stocked with a complete line of NCG industrial gases, arc welders, electrodes, torches and rods, and related accessories; your NCG dealer provides prompt delivery of the equipment and materials needed to keep your production timetable on schedule.

Equally important, you profit from the broad experience and know-how of NCG when you call your NCG dealer. He knows the business and can ably assist your organization in getting the job done right without false starts or costly mistakes and delays.

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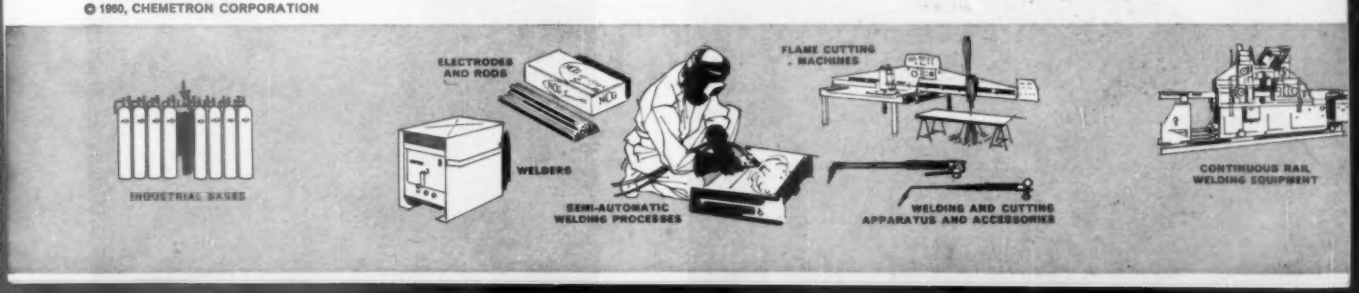
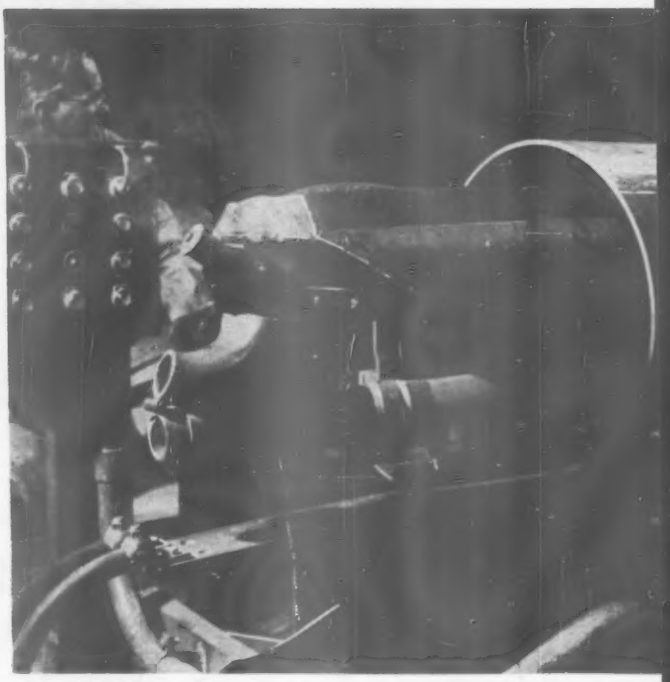


STEP-ON FENDER, fabricated from checkered floor plate supplied by Jones & Laughlin Steel Corp., Pittsburgh, is welded to a mounting angle before final assembly. Pattern gives firm footing when tying a boat to trailers made by Riverdale Boat Trailers, Riverdale, Mich., users of the plate.

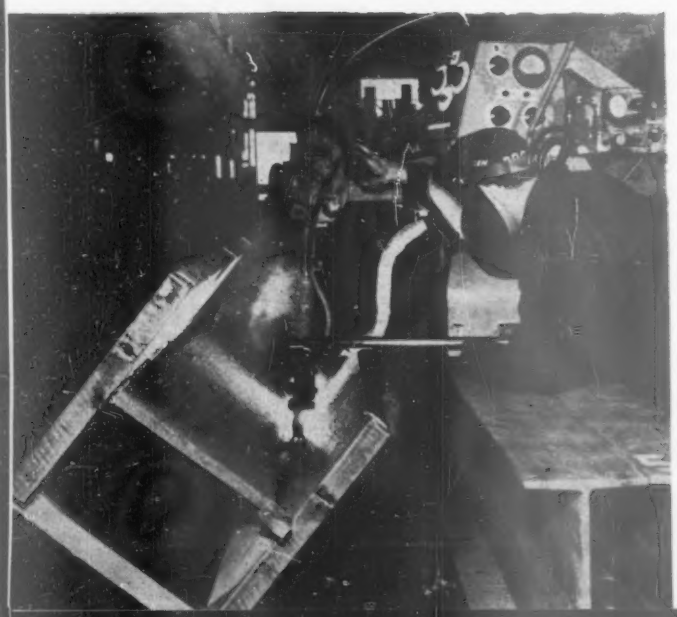


SUBMERGED ARC automatic welding boom begins inside weld on pipe section for Trans-Canada Pipelines. Welding equipment features twin heads from Linde Co., New York City.

LARGEST wet process rotary cement kiln in the Western Hemisphere is welded by Allis-Chalmers Mfg. Co., Milwaukee, for Argentine firm.

On the job...

MIG welding process by British Oxygen Canada Ltd., Toronto, simplifies welding of heavy structural sections for construction at York Steel Co., Toronto.



Brazing used for tube cooling parts

COOLING RADIATORS used to absorb the heat of electronic tubes are being assembled with silver and gold brazing alloys.

As electronic gear becomes more and more complex — and must be confined in smaller and smaller spaces — the amount of heat generated rises to a point where it actually endangers the components themselves.

The cooling units, made by the Baker Setting Division of Engelhard Industries, Inc., Newark, N. J., range in size from 1¼ in. in diameter to parts as large as gallon jugs.

Jewelers' skills possessed by personnel in the division play an important part in the assembling of these components.

Most of the cooling units operate by radiation or convection, or a combination of both. Generally made of copper, they consist of a series of sheet metal fins formed around a hollow core into which

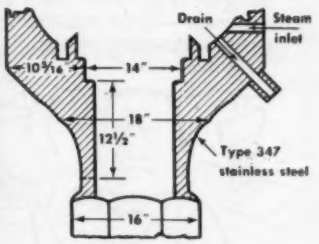
THESE complex metal assemblies are used to dissipate heat generated by tubes in electronic equipment.

the tube fits snugly. Others, which work by fluid convection, are designed with a series of connecting hollow chambers through which water passes.

In some small radiators the fins are formed as a continuous zigzag strip in such a way that, when they are bent in circles, the ends come together perfectly against the side of the ring.

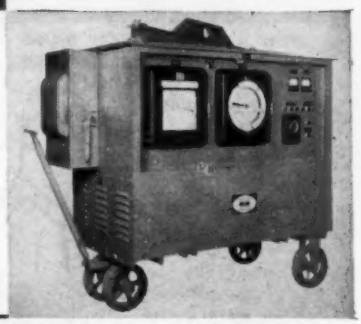
Then they are brazed simultaneously when the ring is brazed to the fins' edges.

Profit through E.A.I. Research



Uniform, through-and-through heating of the thickest sections of the big stainless steel valves was provided by the Smith-Dolan method, with precision control of temperatures (2-hour dwell at 1900°F.). Drawing shows cross-sectional dimensions.

Standard Smith-Dolan units come equipped with eye hooks and wheels for easy portability, and with instrumentation for recording permanent charts of the heat run.



SMITH-DOLAN
On-the-Job HEAT TREATMENT

Solution to Weld Embrittlement Problem at Consolidated Edison

Public utilities are among the largest users of the Smith-Dolan System of Low-Frequency Induction Heating. They want to keep their service uninterrupted, their costs low, and they find that this portable system simplifies the problem of pre-heating and post-annealing in producing sound welds, and in making dependable repairs.

A typical application of the system by a public utility was described in a recent article in Welding Design & Fabrication.* At Consolidated Edison's No. 10 Turbine Generating Station in New York City, two large steam pressure valves made of Type 347 stainless had to be repaired because of weld embrittlement. Removal to the shop for heat treatment would have proved costly and time taking. With the Smith-Dolan portable units, the work was completed on the job within 12 hours.

Learn about the savings and other benefits your company can obtain from the Smith-Dolan System. It is today's most versatile heat treating method, simplifies and upgrades work quality in numerous applications. Write for brochure, "Smith-Dolan System of Low-Frequency Induction Heating."

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DOC TUFFY TO THE RESCUE

TUFFALOY COLD FORMED TIPS do a better job than forged or cast tips. But you weld better with *any* electrode when you follow the suggestions in the Tuffaloy catalog. It has information on tips, shanks, holders, bar stock, accessories and prices. Call your Airco or Tuffaloy office.

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Warehouse stocks in all important cities and towns.

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Induction heating forms plier handles

To IMPROVE the metallurgical quality and finish of their product, one of the nation's largest pliers manufacturers decided to heat its handle blanks rather than form and trim them cold.

A 1,300 F heat had to be reached and cost studies indicated that induction heating would do the job most economically.

Induction Heating Corp., Brooklyn, N. Y., provided the machine which turns out a minimum of 2,000 small units per hour and improves quality at the same time.

The result incorporates a semi-automatic conveyor and two-turn conveyor type work coil. Parts are hung on holding pins at the right side of the conveyor and progress toward the left through the work coil.

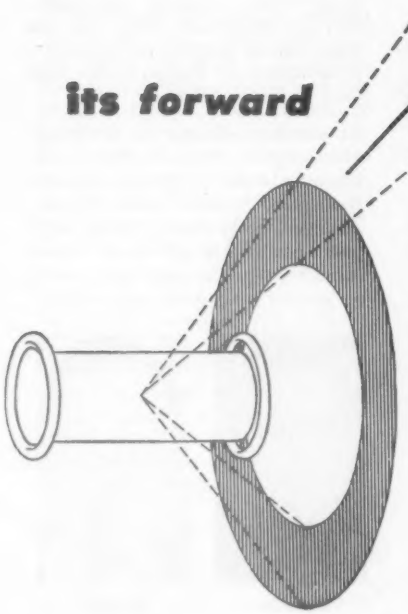
Conveyor and coil are powered from a 25 kw generator; transmission is variable speed, sprocket and chain type.

NINE sizes of plier handles are formed and trimmed on induction heater.

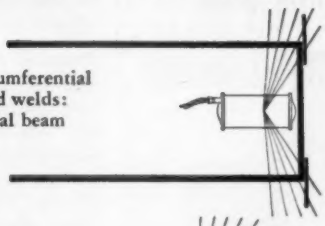
The work coil consists of two turns of heavy water-cooled copper members and heavy staetite support insulators all mounted on heavy aluminum plates and supported by cast bronze brackets. Since the coil is only two turns, it operates at a very low voltage but high-amperage current to prevent possible shock and part-to-work-coil arc-over.

The installation was planned to handle a total of 28 types of plier handles, which can be made possible by moving the part holding blocks and work coil.

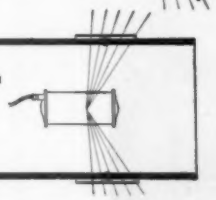
its *forward throw* 360° radial x-ray beam makes light work of tough radiographic jobs like these



Inside-out one shot circumferential radiography of tank-head welds: the forward-thrown radial beam gets the whole corner.



Circumferential radiography of girth welds: the wide-band 30° projection x-rays the full seam with width to spare on either side.



Easy setup for simultaneous panoramic radiography.

Despite the power it packs, the tubehead is light enough for one man to handle.

find all this in the

Easy to position anywhere . . . here it is being lowered for "one-shot" radiography of a massive girth weld.

NEW

ANDREX FT360

160 KV portable x-ray unit

lightweight
one man can easily carry its 72 lb. tubehead

compact
can enter a 9" diameter opening

powerful
full 160 KV takes 2" steel, 5" aluminum in stride

selfcontained
complete weatherproof "package"—no shockproof cables or water lines

economical
an investment that will pay manifold dividends for years for a modest outlay of

Call any Picker branch office (see local 'phone book) or write Picker X-Ray Corporation, 25 South Broadway, White Plains, N. Y.

Picker x-ray

one stop for everything in industrial radiography

ANDREX
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ACCESSORIES

portable x-ray units—130 KV, 160 KV, 200 KV, 260 KV

x-ray units—5 to 50 KV, 150 KV (stationary and mobile), 270 KV portable, 260 KV heavy-duty

units for isotope radiography—sources, equipment, containers for Iridium ^{192} Cobalt ^{60} and Thulium ^{170}

. . . films, tanks, darkroom sundries, illuminators, *everything*

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Most versatile welder ever developed • Instant changeover to manual, automatic, inert-gas spot, MIG and TIG welding • Unique plug-in timers for gas pre-flow, post-flow, high frequency drop-out, spot arc • Patented, dual coil windings in saturable shunt transformer • Sealed silicon rectifiers assure highest efficiency, long life • AC-DC or AC models • Write for data sheet.

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M&T welding products

METAL & THERMIT CORPORATION
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VIPs in review

Alfred T. Rider will move to St. Louis and become district sales manager for Missouri, eastern Kansas, central and southern Illinois and the western border counties of Tennessee for Bastian-Blessing Co., Chicago. Rider will handle much of the area covered by the late *Harry Kaye*.

Richard E. Love has been appointed marketing manager of the Instruments Division of The Budd Co, Philadelphia. Love will be responsible for sales, marketing and promotion. Budd has also appointed *Eugene F. Klumb* district sales manager of the electronic controls section.

The Lincoln Electric Co., Cleveland, has named *A. F. Boucher* assistant general sales manager. Boucher has been Detroit district manager. Lincoln has also transfered *Ronald C. Pierce* from Savannah, Ga., to Mobile, Ala. *James T. Hart* and *Richard K. Lore* have completed a one year training course at the factory and have been appointed to Lincoln's staff of field engineers and assigned to Memphis and Atlanta, respectively.

F. L. Blodgett has been appointed general manager of the Hard Surfacing Div., Alloy Rods Co., York, Pa. Prior to this appointment, Blodgett was the firm's general sales manager.

Blodgett

Fahrenholz

Robert C. Fahrenholz has been appointed plant superintendent of Rexarc, Inc., West Alexandria, Ohio. Fahrenholz, who joined the engineering staff of Rexarc in 1956, succeeds the late *Kenneth Allgrunn*.

Cincinnati Milling Machine Co., Cincinnati, has named *Charles E. Reichel* Chicago district sales manager of the products division. He succeeds *George E. Parker* who has been promoted to assistant sales manager of the division.

Fred Shaltz, formerly representative for Hydro-Line Mfg. Co. has been named Eastern Michigan representative for Helfrecht Machine Co., Saginaw, Mich.

In another change at Helfrecht Machine Co., *Tom W. McMullen*, formerly chief electrical engineer for United Welder Corp., Detroit, has been made chief welding engineer. McMullen will have direct contact with sales and engineering on special machinery applications.

McMullen

Eisenlohr

Poole

Klasson

Alfred Eisenlohr has been appointed manager of the plasma bond division at Thermal Dynamics Corp., Lebanon, N. H. *John W. Poole*, formerly with Bell Telephone Laboratories, Whippany, N. J., has joined Thermal Dynamics as sales engineer. Thermal Dynamics has also named *George A. Klasson* as supervisor of the plasma flame cutter department.

William McGahey, Jr. has been appointed representative for processing and fabrication services for Wallco and Stainless Processing Divisions of Wall Colomonoy Corp., Detroit. McGahey will serve customers in Indiana in sales of tubular and brazed assemblies and heat treating and bright annealing services.

Simon "Si" Fisher, general manager of National Electric Welding Machines Co., Bay City, Mich., has been elected president of the firm replacing Edward C. Smith who resigned to become chairman of the board. Fisher joined National Electric in 1935 as a shop electrician.

Doan Ryle, a specialist in portable industrial X-ray equipment and non-destructive testing operations, has been named manager of the newly formed X-ray division of Labquip, Inc., midwest distributor for Balteau Electric Corp., Stamford, Conn. As divisional manager, Ryle will be responsible for sales and service in the Illinois, Michigan, Wisconsin and Indiana territory.

Robert S. Ames has been appointed general manager of Sonobond Corp., subsidiary of Aeroprojects Inc., West Chester, Pa. Two other new Sonobond executive appointments are *David D. Kirkpatrick*, director of sales; and *W. N. Rosenberg*, manager of engineering.

Stanley R. Burleson has been appointed application engineer of Wall Colmonoy Corp., Detroit. Burlson, who has been in the welding industry for more than eight years, will serve customers in Oklahoma.

Burleson

Lyle

Stulz-Sickles Co., Elizabeth, N. J., has named *W. C. Lyle, Jr.* district sales manager for the east-central section of the U. S. Lyle was formerly associated with Industrial Electrical Appliance Industry.

Emerson Electric Mfg. Co., St. Louis, has elected *William L. Davis* executive vice president. Davis will serve as general manager of the electronics and avionics division.

At Air Reduction Sales Co., New York City, *Dr. J. T. Hugill* has been made manager of tonnage products sales.

Charles L. Costa has been appointed to the new position of field manager of the product service division of The Black and Decker Mfg. Co., Towson, Md. Costa will supervise the firm's product service organization throughout the United States.

Goodrich Welding Equipment Corp., Hudsonville, Mich., has named *George I. Cohen* sales representative in New England and the Eastern Seaboard States. Cohen was formerly in charge of sales for Ames Spot Welder Co., Brooklyn.

Cohen

Clark

W. R. Lummis recently retired from the presidency of Lummis Mfg. Co., Pasadena, Calif., and was elected to the newly-created office of chairman of the board. *D. R. Lummis* was elected president and *C. H. Clark* was made vice-president and general manager.

Norton Co., Worcester, Mass., has appointed *Irvine F. Williamson* superintendent of the firm's Santa Clara, Calif., plant. Williamson joined Norton in 1954 as an industrial engineer.

At a recent directors meeting, *R. B. Hazard*, vice president and sales manager of rubber and packings for Raybestos-Manhattan, Inc., Passaic, N. J., was elected director of the corporation.

Died . . .

Claud L. Hess, 76, one of the founders of Acetylene Service Co., Denver, died recently after a heart attack. Mr. Hess was an employee of the Prest-O-Lite Co., starting in 1906, and formed the Denver firm in 1919. He is survived by his widow, Stella; a son, John C. of Denver; four daughters, Mrs. Jordan Butler of Providence, R. I., Mrs. Dent L. Lay of Washington, D. C., Mrs. William Tyler of Winchester, Mass., and Mrs. Lyman Roach of Denver; and 14 grandchildren.

Edgar N. Luckey, 69, former director of sales of Welsh Mfg. Co., Providence, R. I., died Oct. 17 while attending the 1960 National Safety Congress in Chicago. Mr. Luckey had been active for more than 30 years in the industrial safety and welding field. Mr. Luckey is survived by his widow in Baltimore.

LISTEN

. . . to this: silicon diodes deliver DC most efficiently

M&T Murex DC Rectifier Welder

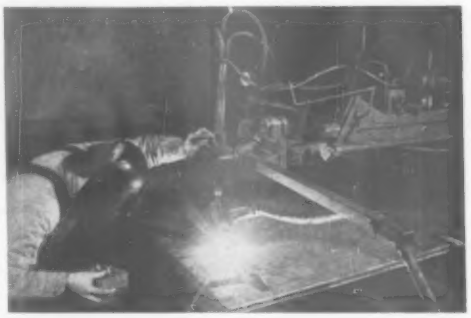
Offers best type of rectifier for this service: non-aging silicon diodes—hermetically sealed • Assure long life, extremely dependable operation, as much as 98% efficiency • Machine designed for instant recovery voltage: arc easily struck, stabilized, maintained • Easy settings: simple selector and knob control for current range, polarity • Write for data sheet.

M&T welding products

METAL & THERMIT CORPORATION
General Offices: Rahway, New Jersey
Circle No. 185 on Reader Service Card

IN SUMMARY . . .

Fen-Thread Machine Co., Inc., Philadelphia, has moved its entire production facilities to larger headquarters at 1910 N. Marshall St. . . . **F. W. Gartner Co.**, Houston, Tex., has announced an expansion program representing an investment of some $75,000 . . . **National Electronics, Inc.**, Geneva, Ill., has built a 23,000 sq ft addition to its Stevens St. plant and has set up a new Thyratron-Rectifier Div. . . .



Installation of Tig equipment for cutting stainless plate (see cut) has been completed at four of **Joseph T. Ryerson & Son, Inc.**'s steel and aluminum service centers. Elimination of the intermediate step of removing burnt powder edges is expected to show a saving on machining costs for users. . .

The research center of **Armco Steel Corp.**, Middletown, Ohio, recently completed its 50th year of operation. Armco has also opened a new sales office at 1834 Penbroke Rd., Greensboro, N.C. . . . The **Resistance Welder Manufacturers' Association** has published three new bulletins, "Seam welding galvanized steel," "Tip life studies in the spot welding of 5052 aluminum alloy," and "Effect of zinc coatings on resistance seam welding of sheet steel." Cost of each is 50 cents. RWMA's address is 1900 Arch St., Philadelphia 3, Pa. . . .

Expanded and improved quarters for its welding service and training activities in the Southwest have been occupied at 2366 Irving Blvd., Dallas, by **Eutectic Welding Alloys Corp., Southwestern Div., Inc.** . . . **General Vacuum Corp.**, East Boston, Mass., has been awarded a contract by the Research Laboratories of **General Electric Co.**, Schenectady, for the design and construction of a new, large scale vacuum facility. . . .

Square-D Co., has moved its Detroit district sales office back to the Madison Heights Plant . . . **D. S. Kennedy & Co.**, Cohasset, Mass., has formed a commercial welded products department . . . **Niagara Welding & Boiler Works, Inc.**, Niagara Falls, N. Y., has changed its name to **Niagara Weldments, Inc.** . . . To increase production of their pickling lines, **Armco Steel Corp.**, Middletown, Ohio, has installed a processor to break up the scale and reduce time required in the pickling tank . . .

The largest commercial vacuum heating furnace in the U. S. (see cut) is now in use by **Aerobraze Corp.**, Wickliffe, Ohio in its new plant in Eastlake, Ohio. Maximum operating temperature of furnaces at the plant is 2,600 F and the lowest vacuum condition obtainable is 0.1 micron . . .

Dye Oxygen Co., Phoenix, has opened a new branch at 221 Chelsea Dr., El Paso, Tex. . . . **United States Steel Corp.**'s Gary steel works will soon be the site of one of the most modern plant metallurgical laboratories in the steel industry . . . A contract to design and construct the S-6 Atmospheric Satellite's stainless steel structure has been awarded to **The Budd Co.**, Philadelphia, by the **National Aeronautics and Space Administration**. . .

ALLOYS
All-State
FLUXES

NOW—join any commercial metal to any other

All-State provides the right alloy, right finish, right flux, and the right service so you can join any commercial metal to any other—on production line or in maintenance.

If you have a welding, brazing or soldering problem (automatic or manual) there is an answer among All-State's specially produced alloys and fluxes.

This answer may be as near as the nearest of over 1000 All-State distributors here and abroad. Or just write or phone (WHite Plains 8-4646) our Technical Department and Laboratories, White Plains, N. Y. A few minutes and a few pennies might save you thousands of dollars.

To help you know the line and select the alloy and flux best suited for each job, All-State publishes a 56-page INSTRUCTION MANUAL, free to interested users. Also, a special ALUMINUM MANUAL containing 36 pages of data on aluminum alloys and how to join them. If you work with aluminum, ask for a copy.

To serve you, All-State maintains 3 factories, 4 warehouses (White Plains, N. Y.—St. Louis, Missouri—South Gate, California—Toronto, Ontario, Canada) and a central Technical Department and Laboratory at headquarters.

ALL-STATE WELDING ALLOYS CO., INC.
WHITE PLAINS, NEW YORK

Circle No. 186 on Reader Service Card

Airless blast cleans metal furniture

TO REMOVE MILL SCALE, welding flux and spatter, and forging scale from metal components, airless blast cleaning proved to be the best answer for a midwest furniture manufacturer.

Wire brushing and pickling proved to be too costly and time consuming for Lee L. Woodard Sons, Owosso, Mich. In addition, it sometimes failed to clean all surfaces satisfactorily.

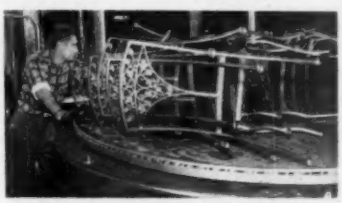
Due to the size and shape of assembled pieces, an airless blast

WROUGHT-IRON pieces before and after blast cleaning.

cleaning machine, manufactured by Wheelabrator Corp., Mishawaka, Ind., filled all cleaning requirements.

With its 96-in.-diameter work table, the unit can accommodate the largest of furniture. In two minutes' time, loads consisting of dozens of pieces are uniformly cleaned by the hard-hitting abrasive blast.

After cleaning the pieces are bonderized. With the possibility that the finished furniture — wrought iron tables, chairs, tea carts, etc. — will be exposed to

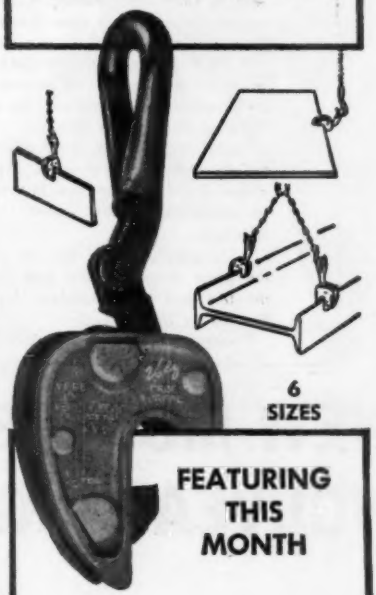


HERE, pieces are arranged on a swing table.

weather, the painted finish is extremely important. With the blast technique, paint adhesion is greatly improved due to the uniformly cleaned surface.

YOUR BEST MOVE . . . MOVE with MERRILL
MATERIAL HANDLING DEVICES FOR THE MOST IN *Safety and Economy*

Imitated, but never duplicated, Merrill Lifting Clamps are Drop Forged to give you Safety in Handling and Economy in Operation.



6 SIZES

FEATURING THIS MONTH

LARGE OPENING "G" CLAMP
Designed for lifting and rolling extra heavy and extra thick plates and slabs. Standard 3" ranges to 12". All capacities.

Over 25 Material Handling Devices described in our catalog C-2.

Ask for a copy.

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Circle No. 187 on Reader Service Card

Reprints from WE

Reprints of certain articles published in Welding Engineer are still available. A list of these appears below. Reprints may be obtained for 15 cents each, except where otherwise noted. Payment must accompany all orders. For quantity orders, write for special prices. Order by title from: Reprint Editor, Welding Engineer Publications, Inc., Box 28, Morton Grove, Ill.

Fundamentals of wear resistant overlay

Explains causes of metal deterioration and how to avoid it and how to select a welding process for hardfacing. This reprint 25¢ each.

Techniques for torch brazing aluminum

Procedures and techniques for brazing aluminum, are detailed. Includes data sheet on brazability of aluminum alloys plus four tables listing commercial products and their characteristics. This reprint is free.

Design for welding

Basic knowledge required when designing, or redesigning for welded construction is detailed and discussed. Sixteen page reprint includes 11 data sheets.

The meaning of weldability

Weldability of carbon steels and alloy steels, as well as some other metals, is discussed. Sixteen page repsint includes three data sheets.

Tungsten inert gas

A 16 page report on the history, theory and application of the Tig welding process. Includes data sheet on proper current selection. This reprint is free.

Welding of dissimilar metals

Complete details on welding dissimilar metals using NiCrFe electrodes and wires. Eight page reprint includes charts on properties, test results and data sheet on properties of other metals.

Acetylene

A 12 page salute to the IAA and acetylene, details the great success of this gas. Includes a history of the IAA and "The Acetylene Journal."

Fixtures for brazing

Presents requirements for designing brazing fixtures and materials to be used. Data sheet on properties of non-metallic fixture materials included. Free.

Selection, welding of CrMo alloy steel pipe

Discusses determining factors in selection of chromium-molybdenum alloy steels and evaluates the effects of pre- and postheat treatment on weld properties.

Filler metals for joining

Brazing filler metals are detailed and each group is analyzed. Includes data sheet on how to select silver brazing alloys.

Production welding controls

Discusses how material, labor and overhead effect total production welding costs, and how certain controls can result in greater time and dollar savings. This reprint is free.

New aluminum alloy not prone to brittle fracture

Extensive testing of 5083 aluminum alloy proves it has excellent weldability and weld ductility, and a good resistance to corrosion and stress corrosion. Testing for brittleness is detailed. This reprint free.

Explosive welding and forming open another door

A report on one of the newest entries into the welding industry, and how one pioneer company turned theories and practices into realities.

Our modern-day mythology

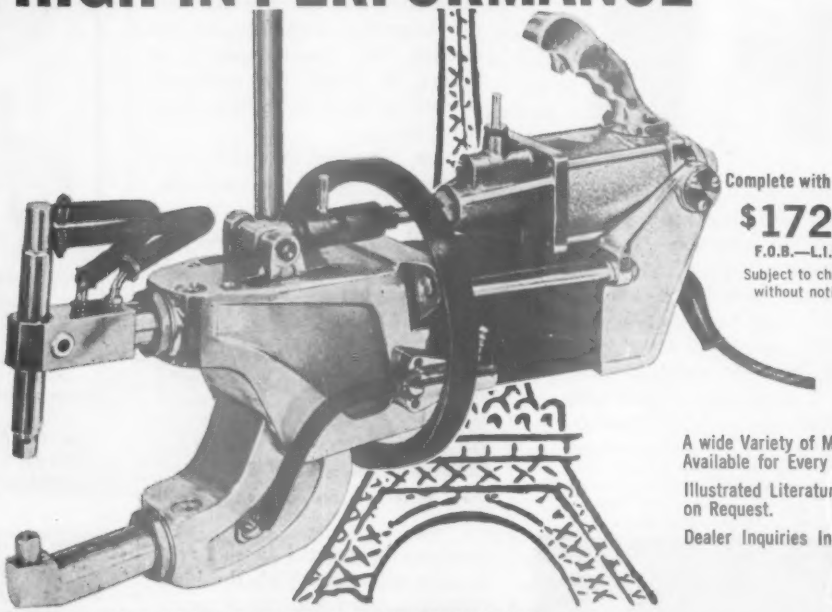
A rebuttal to some old-wives tales about the hazards of welding fumes, plus safety recommendations for situations where hazards might develop.

Understanding weld distortion and shrinkage

Causes of distortion and shrinkage can be determined if weld heat is understood. Eleven drawings are used to illustrate this welding problem.

NEW MODÈLE #407 REACHES NOUVEAU HIGH IN PERFORMANCE

14,000 amps • high pressure • welds from lightest gauge up to 2 x ⅛" • fully automatic single and repeat action • air operated • water cooled • ski-lift type gyroscopic suspension • 10" throat. Extension arms up to 30" available.



Complete with Timer

$1720

F.O.B.—L.I.C.

Subject to change without notice.

A wide Variety of Models Available for Every Job.

Illustrated Literature on Request.

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ARO SPOT WELDER DIVISION Guthery Machine Tool Corporation

38-31 CRESCENT STREET, LONG ISLAND CITY 1, NEW YORK

DO YOURSELF A GOOD TURN

See how A. O. Smith makes industry's only extra-heavy-duty welding machine

a view to value

CAPACITORS — Standard with A. O. Smith Extra-Heavy-Duty welders is the industry's maximum power factor correction — capacitors deliver 134 M.F.D. total. This high power factor means that the current taken from the primary line is lower than with any other machine when comparable ratings are matched. This more efficient use of primary power means more money saved through lower power bills.

SHELL—A. O. Smith Extra-Heavy-Duty welder is enclosed in an attractively designed, sturdy steel shell. Heavy-gauge steel throughout to withstand the roughest treatment. Frame and case retain "new" appearance throughout exceptionally long machine life. No danger here of being prematurely traded on the basis of looking "worn out." A machine that doesn't look its age lives longer.

CORE—Superior welding characteristics are insured through "U" core design. Because the adjustment is by magnetic field in air instead of iron, there is less electrical inertia. This results in a faster, more positive arc response. Better arc characteristics cut costs through reduced weld repair and improved, more efficient operator performance.

COILS — A. O. Smith's extra-heavy copper coils are the heaviest in the field—primary and secondary coils together weigh 185 lbs. on a 500-amp machine. This means rise of only 55°—lower than with any other on the market. In addition, coils have vacuum-impregnated silicone class "H" insulation — the highest temperature protection in use. Features like this insure longer, more dependable machine life.

COOLING SYSTEM — No other machine packs so much cooling power. Biggest fan in the field. Air is circulated by an 18-inch industrial-type fan — dynamically balanced and scientifically pitched to deliver maximum ventilation down through the coils. Power behind the fan is a big, totally enclosed, lifetime-lubricated motor providing more air for cooler operation and longer life.

SWITCH—Open-and-shut case for A. O. Smith superiority. A molded case circuit-breaker-type on-off switch controls primary power to this machine. All contacts are enclosed to prevent dirt and other foreign material. This in contrast to switches used in most other welding machines of value in the form of open-face, dependable means of reducing maintenance costs.

To detach — just tear along dotted lines

ONLY A. O. SMITH LETS YOU PAY YOUR MONEY AND TAKE YOUR CHOICE!

Through research ... *a better way*

A.O.Smith
CORPORATION

WELDING PRODUCTS DIVISION
Milwaukee 1, Wisconsin
A. O. Smith INTERNATIONAL S.A.,
Milwaukee 1, Wis., U.S.A.

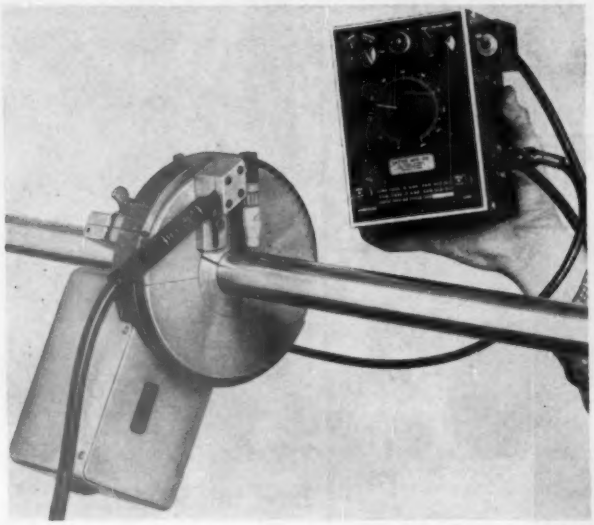
Why pay your money and take a chance? A. O. Smith lets you pay your money and take your choice — a **value** choice of both Extra-Heavy-Duty and Standard-Duty welding machines.

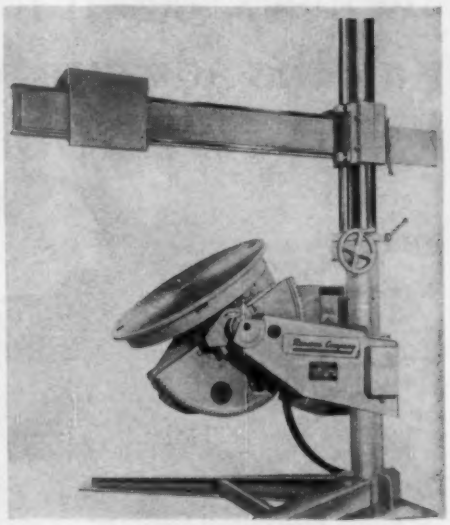
The value gauge on the front of this advertisement tells the inside story of A. O. Smith Extra-Heavy-Duty welders. It reveals that A. O. Smith is the only manufacturer that still builds a real Extra-Heavy-Duty welding machine — a welder designed and constructed with safety factors established 20 years ago for long life under the most severe operating conditions.

But, of course, for standard duty, A. O. Smith offers the MonArc shown at left. Here is industry's quality, low-cost welder. Available in 300, 400 and 500-amp models. More copper in the coils than any other competitive welder of the standard class, means this rugged welder will give you years of dependable operation. The MonArc is the picture of compactness. It racks! It stacks up to three high! It slides under a bench. Fits where others take up valuable floor space.

See them both at your A. O. Smith distributor. Or write for full details.

New products . . . . . use card on page 83





Tube welder

Stainless steel tubing and fittings can be automatically welded in any position from horizontal to vertical with only 6-in. clearance required from tubing center to adjacent obstacles. Welder is completely independent, except for necessary inert gas and welding leads, making it possible to use in remote areas or on different floors away from actual arc welding machine. Interchangeable adapters are furnished to permit accurate welding of sanitary tubing and fittings up to 3-in. OD. Standard adapters included, 1½, 2 and 2½-in. OD. Other sizes available on special order. Control box weighs 6½ lb; welder weighs 19¾ lb. *Latter Mfg. Co.*

Circle No. 1

Projection welder

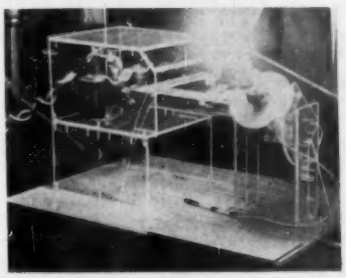
Press type projection welder equipped with special four-station dial-type upper die holder permits operator to choose station by pressing button. Unit has 48-in. throat depth from center line of slide to front face of frame and lower arm is made of fabricated steel with cast copper conductor. Unit is powered with 500-kva water-cooled welding transformer arranged with 16 heat-regulation steps, and can provide maximum secondary short circuit amp of 100,000 amp. Unit's anti-friction roller bearing slide is operated by 12-in. diameter air cylinder developing a maximum weld force of approximately 9,000 lb at 80 psi air line pressure. *The Federal Machine & Welder Co.*

Circle No. 2

Hardfacing rods

Cast and centerless ground hardfacing rods made to exact customer chemical specifications are principally cobalt-base alloys with high percentages of tungsten, chromium and carbon and minor amounts of nickel. Other base metal types can be obtained to specifications. Rods can be applied by oxy-acetylene flame or electrode coated for application by a-c or d-c electric arc deposit methods. Rods are centerless ground to nominal dimension for bare rod applications and centerless ground to ±0.002-in. for electrode coating applications. Bare hardfacing rods are available in 1/16, ¼, 5/32, 3/16, ¼, 5/16 and ⅜-in. diameters; ¼-in. to ⅜-in. rods are furnished in controlled lengths of 14 in. and can be butt welded to give extendible lengths up to 8 ft. Rods of 1/16-in. diameter are available in random lengths from 6 in. minimum. *WaiMet Alloys Co.*

Circle No. 3



Plasma torch

Plasma torch using an RF field to generate heats approaching temperature of the sun, yet without consuming any fuel or electrodes operates by using energy of high frequency electromagnetic field to dissociate and ionize gas molecules into component atoms and allowing them to recombine into original state. When recombination occurs, absorbed energy is liberated as heat. Electromagnetic field is created by coil or coaxial cable. In one unit using a coil, energy is generated by Amperex type 5866 transmitting triode operating at 27 mc with 250-watt output. Another unit uses coaxial cable with energy generated by Amperex type 7292 magnetron operating in S Band (2450 mc) with a 1 kw output. Temperatures in excess of 3,000 C have been achieved and experiments are underway to reach 5,700 C. *Amperex Electronic Corp.*

Circle No. 4

Welding station

Complete automatic welding station consists of 4-ft by 4-ft Ransome manipulator combined with a Model 25P positioner joined by fitting manipulator mast into positioner post. Positioner can handle 2,500 lb, has precision electronic variable speed drive, power operated tilt, and remote operator's control station. Manipulator is manually elevated for arc height adjustment by means of an Acme screw; head support side beam carriage is manually adjusted with rack and pinion and lock to cover welding area handled by positioner table. *Ransome Co.*

Circle No. 5

Safety spectacles

Plano-type spectacles come in three models: Airco 60, without sideshields; Airco 61, with partial sideshields; and Airco 62 with full sideshields. Super hardened lenses provide impact protection in machine or laboratory work. One bridge size guarantees fit for 90% of users without special fittings or adjustments. *Air Reduction Sales Co.*

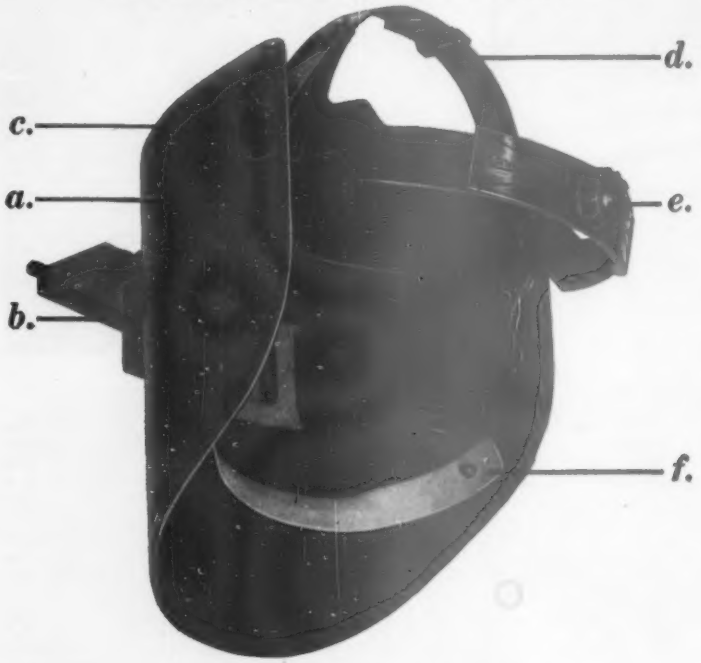
Circle No. 6

Welding-cutting outfit

Medium-size, full-capacity welding and cutting outfit available in rugged tool box includes full-size heavy duty gas regulators, full 25-ft double line hose, four welding tips, one medium-size cutting tip and all accessories. Flexible Star-Jet welds all metals, brazes, solders, and provides heat for bending, forming and cutting steel. *Marquette Mfg. Co.*

Circle No. 7

Next time you pick up your helmet...see if it gives you all the advantages of this OXWELD helmet



a. *One-piece seamless shell* molded from tough glass-fiber-reinforced polyester resin—lightweight, easily cleaned, strong, non-warping.

b. *Flip-front glassholder* die-cast from aluminum, stationary glassholder molded as integral part of shell for a light-tight seal.

c. *Fingertip tension adjustment* to hold helmet in up or down position. "CP" joints of durable plastic will not pass electric current.

d. *Adustable crown strap* holds helmet firmly in choice of five positions.

e. *Rear knob* instantly adjusts headband size over wide range without need for removing helmet.

f. *Adustable fiber chin rest* assures proper visual alignment and maximum comfort.

Compare these advantages with those offered by any other helmet. There are eight different types of OXWELD helmets and handshields. And each is designed with every advanced feature for maximum protection against infra-red and ultra-violet rays, sparks, and molten metal.

Comfort is a big factor. OXWELD helmets have been given the careful detailing that provides easy, instant adjustment, snug fit, and the "free-floating" suspension that eliminates pressure points. You can choose from three sturdy shell styles.

See them at your LINDE distributor's. Or write for literature and price lists. Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N.Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY

UNION CARBIDE

"Linde", "Oxweld", and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Inert arc welders

Inert arc a-c welders have NEMA rated outputs of 200, 300 and 400 amp. Design features simplified, foolproof gas afterflow device which eliminates need for complicated timers. Spark gap oscillator with silencing circuit included produces high-frequency pulses for instant starting and arc stabilization. Transformer uses patented dual-coil construction delivering balanced wave output for smooth operation, high starting voltage and high power factor. *Metal & Thermit Corp.*

Circle No. 8

Abrasive discs

B14 abrasive discs available in wide range are made with aluminum oxide or silicon carbide abrasive in all types. Made with inserted nuts or studs as required for mounting, discs are available in plain types or with perforations for cool and free cutting if necessary. Discs with radial slots for better coolant distribution are also available. Zoned discs (with increasing hardness from center to periphery) are made in large sizes to maintain uniform grinding action and disc thickness on work passing between discs. *Norton Co.*

Circle No. 9

Ultrasonic generator

Two km variable-frequency ultrasonic generator covers wide range of output frequencies, power levels, and impedances. Generator provides flexibility for optimum power determination frequency and impedance for specific applications. Unit allows trial of widely-differing transducers and loading conditions and permits general investigation unhampered by limited output values. Frequency range is 1 to 100 kc with output up to 2 mc available. Power ouput is continuously variable from 9 to 2,000 watts at frequencies of 1 to 50 kc, and to 1,200 watts up to 100 kc. Units with lower maximum power output are available. *International Ultrasonics, Inc.*

Circle No. 10

Power supply

A 500 watt-second stored energy electronic welding power supply with range selector switch for finer control at low settings and automatic lockout to prevent premature discharge is designated VTW-33. Range selection switch permits use of full meter scale from 2 to 50 to 20 to 500 watt-seconds. Switching ranges automatically discharges stored energy, changes meter calibration and allows power supply to charge to new setting. Unit's 2½ millisecond pulse width at 500 watt-seconds is shortest weld energy discharge of any stored energy welding equipment, company states. *Hughes Aircraft Co.*

Circle No. 11

Split-sleeve

Split-sleeve, 24-in. diameter by 54-in. long designated for 950 psi maximum working pressure, has body of 1⅜-in. thick firebox quality ASTM A-285 certified steel plate, grade C. Side bars are C-1020 hot rolled steel. Bolts are 1⅝-in. diameter B-7 alloy steel. Nuts are C-1018 cold rolled steel, made with chamfered bottoms to facilitate seal-welding. Ends are turned down for fillet-welding to pipe. Side bar spaces and bolts may be seal-welded and welding may proceed with pipeline in service. *The Pipe Line Development Co.*

Circle No. 12

D-c arc welders

Three phase rectifier d-c welders (Idealarc R3M series) designed to NEMA industrial standards of 40 volts, 60% duty cycle, incorporate silicon rectifiers to produce d-c output in four sizes: 300, 400, 500, and 650. Output characteristics of rectifier design are engineered to prevent electrode sticking on low-current, small-diameter electrode applications. Front panel contains current control for continuous full range output adjustment without making intermediate range changes. Standard equipment includes polarity switch for reversing current flow without charging cable connections. Wiring a push button magnetic line contactor to strategically placed thermostats prevents thermal damage from overload, lack of ventilation, or single phasing. *Lincoln Electric Co.*

Circle No. 13

Fibre helmets

Due to popular demand, old-time Huntsman helmets Nos. 411 (above), 412 and 430 are now available again after being discontinued a few years ago. All models are adjustable, made of vulcanized fibre, and have overhead strap adjustable to rest across crown of head distributing weight of helmet over entire head, eliminating tight headband. *Kedman Co.*

Circle No. 14

Safety hat liners

Safety hat liners designed for outdoor industrial activities are available in wide variety of styles and prices. New liners fit all hats, all workers, and feature lightweight durable materials for warmth and ease of washing. Metal-free design permits use by workers exposed to electric shock hazards. Styles include Model FC-2 with ¾-in.-deep all-orlon pile lining and Model FC-4 with removable ear flap that attaches to cap with all-plastic zipper. *Jackson Products.*

Circle No. 15

Safety glasses

Plastic frame safety glasses (720 series) in S-7 square shape lenses feature universal bridge that fits 9 out of 10 faces without adjustment. Glasses provide full frontal eye protection and come in choice of broad spatula or vinyl coated cable temples; flesh or translucent charcoal frame colors; 6.00C clear, green or didymium lenses. *Sellstrom Mfg. Co.*

Circle No. 16

SPECIALIST-

your
LINDE distributor

It takes more than a line of welding equipment to be a LINDE distributor. It takes real knowledge of your welding needs . . . knowledge of local industry . . . practical experience and interest in efficient welding operations . . .

These are some of the qualifications that make your LINDE distributor so valuable to your business. He's a specialist in his field, equipped with a complete stock of welding and cutting equipment, industrial gases, welding rods, supplies, and accessories. They're all products of highest quality and proved efficiency. Your LINDE distributor is ready to help you today, with equipment, expert advice, and the benefits of LINDE's 50-odd years of welding and cutting leadership.

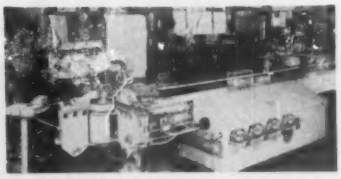
A telephone call will prove the point. Look up your LINDE distributor in the classified directory. Or write to Linde Company, Division of Union Carbide Corporation, 270 Park Avenue, New York 17, N. Y. *In Canada,* Union Carbide Canada Limited, Linde Gases Division, Toronto 12.

LINDE COMPANY

UNION CARBIDE

"Linde" and "Union Carbide" are registered trade marks of Union Carbide Corporation.

Circle No. 190 on Reader Service Card



Tube bender, cutter

Automatic bending and cutting machine can make two 90 deg bends and cut pipe in a four-second operation. Tube is set, engaged in sliding pressure die and advanced to clamp which instantly starts bending arm which rotates to the stop. Pressure die and madrel are then withdrawn and sawing cycle takes place. Completion of sawing cycle causes clamp to release so air exhausters can eject tube. Arm then returns to starting position to restart cycle. Entire operation takes four seconds. *Wallace Supplies Mfg. Co.*

Circle No. 17

Magnesium cleaner

Bernite BR4 cleans surface of magnesium to allow spot welding and welding. Compound will remove dirt and all surface oxides leaving mirror-like finish without changing dimensions of metal, states manufacturer. Cleaner is dry powder used in concentrations of 1 to 1½ lb to the gallon of tap water for two minutes. No fuming, toxicity, heating or handling problems are involved. *Bernard Chemical Products Co.*

Circle No. 18

Heat treating unit

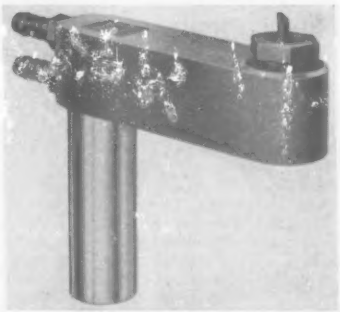
Portable, two-in-one, combination heat treating unit designed for exceptional flexibility in weldment heat treatment is self-contained, transformer-type electrical heater equipped for induction and resistance heating. Unit, mounted on wheels, will stress relieve pipe weld in 2-in. to 14-in. OD pipe with wall thicknesses up to 2 in. at temperatures to 1,375 F, with each of two 40 kva sections in accordance with code requirements. Two sections can be used together or separately at 50 or 60 cycles for induction heating with 1,000 amp at 40 volts, or 500 amp at 80 volts (using small wire when advantageous), or for resistance heating with Falcon type resistance coils. *Electric Arc, Inc.*

Circle No. 19

30 kw generator

Ther-Monic 30 kw generator can produce power at high and low frequencies. By flicking selector switch, unit can operate at 250 to 450 kc and 1 to 7 mc. Externally-operated built-in controls, coils and fixtures mounted in front of generator for connection to outputs, and external grid adjustments on both frequencies are unit features. Generator can be adapted to such diverse applications as soldering, brazing, annealing and hardening. Variable out-put transformer for low frequency operations and completely adjustable tank for high frequency heating jobs are housed in dust-tight cabinet. Heat exchanges for water and cabinet cooling are built in. *Induction Heating Corp.*

Circle No. 20



Offset tip holder

All-aluminum offset spot welding tip holder is slice of aluminum extrusion. Holders are light in weight, corrosion resistant and made with threaded tip adapters. Tip adapters carry brunt of holder wear at tip socket and are easily replaced. When alternating between 4 RW and 5 RW taper electrodes, only adapter and adjustable water tube need be changed. Holders come in standard 2-in. and 4-in. offset with shank diameters of ⅝, ⅞, 1, 1⅛, and 1½ in. *Air Reduction Sales Co.*

Circle No. 21

Coated electrodes

Alloy No. 56 for high-temperature service, available in coated welding electrode form, has an ultimate strength in solution heat treated condition of approximately 26,000 psi at 1,800 F. Parts can be produced in this alloy by sand-, investment-, and resin shell-mold castings. *Haynes Stellite Co.*

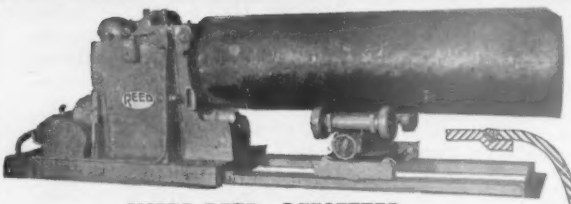
Circle No. 22

WEBB TANK PRODUCTION MACHINERY

Unit Type Turning Rolls

Portable Turning Rolls

Automatic Welding Track Supports



WEBB-REED OFFSETTER

This machine forms an offset flange around shell ends to facilitate automatic welding tank heads. It eliminates chill rings, decreases fit-up time, improves the concentricity of shell ends, and aids in reducing actual welding time. Tight, clean joints result. Three sizes of Offsetters handle up to ½" plate with standard dies. Illustrated with Turntable for reversing shell ends when both ends are to have offset flanges formed.

Permits rapid fit-up of tank heads into tank shells where offset joggle joints are used. Hydraulic pressure is applied through ball-and-socket swivel joints that allow the head cups to set to the head. Hydraulically powered kick-outs speed up loading and unloading. Both headstock and tailstock are adjustable vertically; tailstock is also adjustable along the bed for various lengths of vessels up to 18'.

Fit-up rolls are also available to facilitate proper alignment and assembly of shells lacking rigidity.

WEBB-REED ASSEMBLY PRESS

Horn Type Fixtures | Cylinder Flange Offsetters | Assembly Fixtures

Write for illustrated literature

Since 1881 THE WEBB CORP.
REED EQUIPMENT DIVISION
WEBB CITY, MO., U.S.A.

Wide-vision helmet

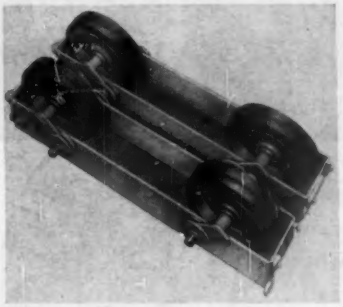
Wide-vision welding helmet provides large-view 19-sq-in. lens opening. Lens is seated in leak-proof non-electrical conducting neoprene holder which simplifies lens removal and replacement. Impact and fire resistant holder allows cover lens removal in seconds. Helmets furnished with fiberglass or vulcanized fiber and snap-in Fit-Rite headgear or safety cap. *Flood Safety Products Co.*

Circle No. 23

A-c/d-c welder

Gas engine driven a-c/d-c welder (Model SGAD-225-L) produces 300 amp at 30 volts a-c, or 225 amp at 30 volts d-c welding current at 100% duty cycle. Unit is compact for movement on trailer or hand running gear. Welder functions efficiently for Mig; with high-frequency conversion unit it functions as a-c Tig welder. Unit produces 115/230 volt single-phase 60 cycle a-c power for operating lighting systems and for emergency use and can produce 115 volts auxiliary d-c power while welding. Unit is 53-in. long, 25-in. wide and 36-in. high, powered by Kohler 24.4 hp engine with electric starter. *National Cylinder Gas Div.*

Circle No. 24



Pipe rolls

Adjustable pipe and tube rolls feature rubber tires, roller bearings, and all-steel construction. Unit can handle 2-in. to 36-in. diameter cylinders with capacity of 1,000 lb. Units can be ganged for greater capacity or for handling short pieces. Equipped with pilots for automatic alignment and a solid base making it ideal for field work, unit has no loose parts requiring adjustment. Roll can be used as outboard support for positioner or head and tailstocks as well as auxiliary support for turning rolls. *Ransome Co.*

Circle No. 27

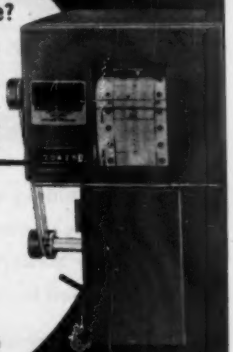
Circle No. 209 on Reader Service Card

increase production

by automatic time measurement of manual and automatic electric welding performance

how much time should a welding job take?

WELD-RECORD provides automatic, permanent (paper tape) records of productive vs. non-productive welding time.



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1. Accurate time-study data
2. Computing job costs
3. Reduces downtime
4. Setting job standards

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Dept. E-12 2105 DAWSON ROAD ALBANY, GA.

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THE DURO "STANDARD"

* Featuring "Long Jaw Design" for reaching hard to get at places.
* Cool operation-cool handling.
* Insulated handle and guard protects the operator.
* All parts easily replaced.

THE "ADJUSTABLE TENSION"

* Easy adjusting of Spring Tension for your requirements.
* New type cable connection prevents fraying of cable.
* Aluminum model weighs only 13 oz.
* All parts replaceable including copper alloy jaw.

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Miss Liberty says:
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Dockson Welding and cutting torches are lighter, better balanced, built to last with rigid, silver soldered one piece construction. Designed to do the job better, faster.

Service parts available from stock.

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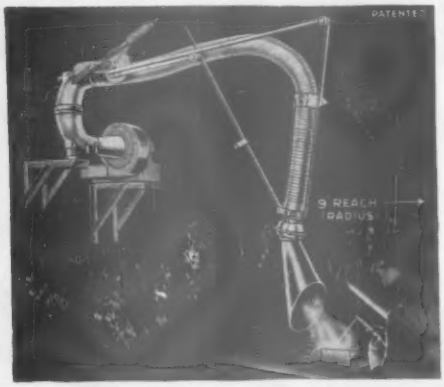
RUEMELIN Fume Collectors

Welding without ventilation. Note smoke and gas clouds.



(Right) Welding with Ruemelin Fume Collector.

REMOVE WELDING FUMES at the Source!

Ruemelin Fume Collectors remove smoke, gas and welding heat. Keep the shop air clean. Efficient and practical. Maximum coverage in welding areas. Your welders work better with this equipment in use. Write for bulletin 37-E describing the new spring-loaded counterbalance mechanism.

Long reach collector extends working range of hood to 15 ft. or 18 ft. operating radius. Double swivel permits hood to work in 360° circle for full coverage.

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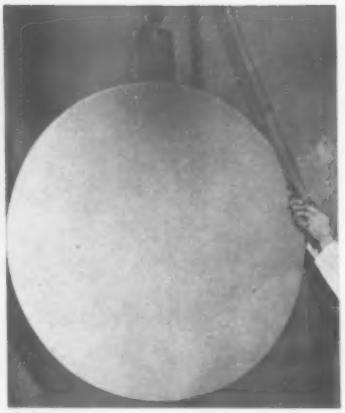


Lifting tab

Clad metal 4-in. by 6-in. tube sheets have welded-on lifting tabs to minimize handling problems. Tab 1-in. thick is welded to base metal of tube sheet and drilled to accept standard ⅝-in. clevis pin. After handling, tab is easily removed by torch or other cutting methods. Safety and economy are principal advantages of lifting tab, according to manufacturer. Tabs are supplied at no extra cost when requested. *Bridgeport Brass. Co.*

Circle No. 29

Paddle-type holder

Tuffaloy paddle-type spot welding tip holders, designed for welding in confined areas, provide cost savings because tee connectors are not required, according to manufacturer. Holder comes with standard 4-in. offset, and is available in shank diameters of ⅝, ¾, 1, and 1¼ in. Holder uses socket-type tips, available in tour nose designs. Tips can be inserted on either side of paddle. *Air Reduction Sales Co.*

Circle No. 30

Toggle clamp

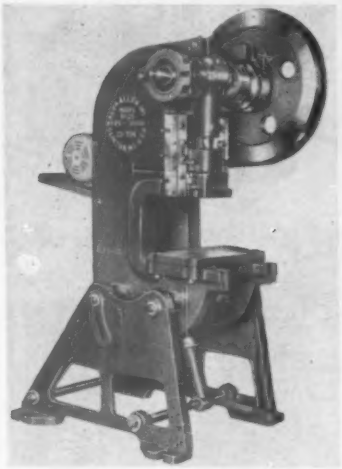
Medium-heavy duty, air or hydraulic-operated 6-lb 6-ounce toggle clamp with rated holding pressure of 2,500 lb has clamping pressure of 300 lb. Forged alloy steel base is mounted on steel plate for long service. Over-all length in forward position is 13 15/16 in., width 3 in. and distance from bottom of base to plunger centerline is 1 1/16 in. Plunger, copper plated with Irrelac finish to resist weld spatter, is tapped for ⅜-16 adjustment spindle. *Detroit Stamping Co.*

Circle No. 31

Galvanized sheet

Differentially zinc-coated sheet featuring corrosion-resistant, hot-dip zinc coating on one surface and smooth spangle-free finish on other combines paintability with good spot welding characteristics while providing corrosion protection. *Armco Steel Corp.*

Circle No. 32



Punch press

Punch press has die space of 7⅝-in. shut height and 8-in. throat. Model BT-25 can set up for any standard punch press operation such as blanking, forming, shearing, drawing, cutting, punching or crimping. Press can be easily changed from repeat to non-repeat action. Adjustable vee-type ram gibs are 14-in. long. Crankshaft diameter at main bearing is 2⅞ in. with extra long bronze main bearings of 5 in. Die bed is 12 in. by 21 in. with opening in bed 5 in. by 8 in. Mechanical tilting mechanism allows press to incline to 30 deg. Standard stroke is 2½ in., with other ¾-in. to 4-in. strokes available in ¼-in. graduations at extra charge. Unit requires 2 hp motor. Net weight of total unit is 2,900 lb. *Alva Allen Industries.*

Circle No. 33

Silicon rectifier welder

A-c/d-c silicon rectifier welding machine with full 100% duty cycle is rated at 500 amp. Designed to replace 600-amp motor-generator sets on semiautomatic submerged-arc welding applications, unit is suited for large butt and fillet welds. A-c section is suited for use with heavy iron powder electrodes. *A. O. Smith Corp.*

Circle No. 34

For more facts Circle No. 195 on Reader Service Card

ACRO WELDER MFG. CO.
MILWAUKEE
WELDING ENGINEERS
MACHINERY BUILDERS
ESTABLISHED 1938

ACRO® general purpose spot-projection-butt-seam resistance welding machines.

ACRO-ARC® special purpose production welding machinery employing automatic arc welding processes.

ACROMATIC® special purpose production welding machinery employing resistance welding processes.

ACRO-MAGNETIC® magnetic force spot, projection, and percussion welding machines.

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- "ROYAL" Hardening Powder is more effective than cyanide. Gives off no dangerous fumes. Simplifies the work. Economical to use.
- Makes low-grade steel perform like high-grade steel.
- Enables the weldor or blacksmith to produce a finer cutting tool without technical equipment.
- Produces a .01 to .02 in. case depth with necessary Brinnell toughness on large and small low-carbon steel tools and parts.
- Send for sample and descriptive booklet.

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ROUND SOAPSTONE HOLDER

★ SATIN-FINISH ALUMINUM
★ HANDY POCKET CLIP
★ POSITIVE BUILT-IN CHUCK

Solid 7/16" aluminum construction. For 1/4" round soapstone. Built-in knurled chuck positions and firmly holds soapstone. Complete with 5" stick of No. 1 select grade soapstone.

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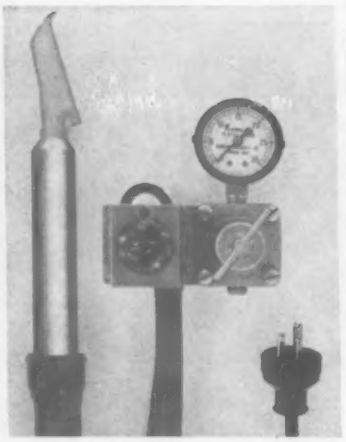

Thermoplastic welder

Kamlar Model 12-AW all-purpose hand welder is designed for welding and tacking thermoplastics such as polyethelene, polypropylene, PVC, and plasticized tank lining. Unit can be used in shop and field with production rate up to 60 ipm. Supplied with tacker tip and one round tip, unit has three-heat metal heat element with output up to 800 watt. Unit is furnished with 16-ft neoprene air hose terminating in an insulated, air-cooled handle, and can be plugged into any 115 volt a-c outlet. *Kamlar Products Co.*

Circle No. 35

Welder-power plant

Combination d-c welder and a-c power plant (GW-2235-S) provides 200 amp d-c at 25 volts on 100% duty cycle for straight or reverse polarity welding. Unit has welding range of 30 to 325 amp for intermittent use. Power output is 2 kw at 110 volts a-c of auxiliary power when welding, or full 5 kw of 110/220 volts a-c current when unit works as a generating plant. Welding controls, welding terminals, four 110 volt a-c power receptacles and two 220 volt 3-wire-twist lock outlets are located on panel at generator end of unit. A 14.2 hp, 2 cylinder, air-cooled Wisconsin gas engine powers generator. Trailer is optional. *Hobart Bros Co.*

Circle No. 36

Pattern paper

Pattern paper, called Alexandrite, is new type used on flame-cutting machines. Paper possesses good dimensional stability and is used extensively in cutting steel shapes and various other operations. *Alexander Paper Co.*

Circle No. 37

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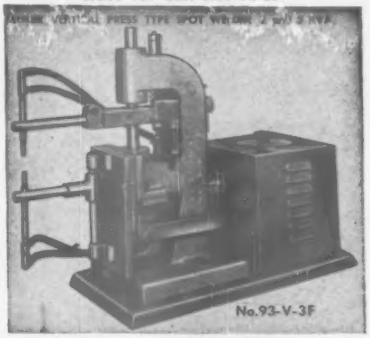
EISLER VERTICAL TYPE PRESS WELDERS

We also make a complete line of Spot and Wire Butt Welders.

Write for Cat. No. 93-57



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No Other Product Can Do a Galvanizing Job Like

Galvalloy

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Heat welded seam on galvanized sheet to 600° with Torch

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GALVALLOY Covers the Same Amount of Area with 1/5 the Amount of Material.

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Free Literature

. . . use card on p. 83

89. WELDING EQUIPMENT — Kirkhof Mfg. Co. Bulletin No. E60-1, eight pages, gives case histories of equipment and contains illustrations of resistance and arc welders, welding guns and stations.

90. INDUSTRIAL RADIOGRAPHY — Eastman Kodak Co. 16-page booklet lists firm's materials and accessories for industrial radiography with tables and illustrations.

91. WELDING ELECTRODES — Shober, Inc. 16-page illustrated booklet lists electrodes to be used in various mild steel, hardfacing and gas wire welding operations.

92. PLASTIC WELDING — D & R Plastic Welders, Inc. Catalog includes new items in plastic welding and fabricating line.

93. X-RAY UNIT—General Electric Co. Product Data Sheet A4316 gives specifications of firm's OX-250 oil-immersed X-ray unit.

94. INDUCTION HARDENING — Tocco Div., The Ohio Crankshaft Co. Catalog 22 Section B gives typical results of firm's induction hardening and heat treating

95. PLASTIC WELDERS — Kamlar Products Co. Bulletin 60-1 describes firm's plastic welders with illustrations.

96. AUTOMATIC WELDING SYSTEMS — Stoody Co. Four-page, two-color, Form No. AD-115 illustrates and describes firm's automatic welding systems.

97. NON-DESTRUCTIVE TESTING — Sperry Products Co. Bulletin 73-100 describes new line of magnetic particle inspection equipment and supplies for nondestructive testing.

98. ELECTRON GUN — High Vacuum Equipment Corp. Bulletin No. 602 describes orbiting electron gun and gives features.

99. SAFETY SHIELDS — Frommelt Industries, Inc. General catalog lists and illustrates firm's protective shields and screens.

100. PROJECTION WELDER — Thomson Electric Welder Co. Bulletin 4-0-20 describes firm's new two-column direct-tension head projection welder.

101. SPOT WELD GUN — Bren Weld Corp. Catalog 302 illustrates and describes automatic spot weld gun which eliminates need for drilling, tapping or riveting.

102. WELDING HEAD — Raytheon Co. Product Data 2-207 is four-page, two-color description with diagrams of firm's welding head Model M.

103. SCROLL BENDER — Hosafeld Mfg. Co. — Data sheet gives specifications and price for firm's hand operated scroll bender.

For more facts Circle No. 207 on Reader Service Card

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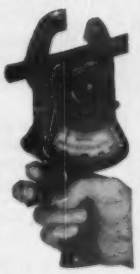
Weld with confidence. Use the exact amperage — no more, no less—to assure welding quality. Prevent costly rejects by controlling the welding current (AC or DC) with one TONG TEST AMMETER. Simply snap tongs around electrode cable — read amps instantly and accurately. No electrical connections required, cannot burn out. Interchangeable ranges up to 1000 amperes.



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IRON WORKER

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No Grinding Necessary After Cut. One Stroke Cycle Clutch Operated by Hand or Foot.

The Bateman "Bantam" cuts 2" x 2" x ¼" angles and ¼" x 4" flats. Standard punches will fit this machine. The Coper will cope 1¼" through ⅛" material. It will punch ½" hole through ¼" material. With the clutch open, the Bantam will make 44 strokes per minute. It is made of high-grade cast iron, with the clutch, pin and dog made of hardened steel. The blades are made with tool steel. It is powered with a fly wheel and gear drive, and uses a small ¾ hp motor, 1750 rpm.

Bateman Bantam with punch....$575.00
Shear only $495.00
Shipping wt. 750 lbs.

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MINERAL WELLS, TEXAS

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CAST IRON WELDING RODS OR ELECTRODES

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FUSE-WELL No. 11, *Square*—Gray Cast Iron Welding Rod for Acetylene use in filling or building up new or worn castings producing machineable welds.

FUSE-WELL NO. 12

FUSE-WELL No. 12, *Round*—Has the same uses and analytical ingredients as Fuse-Well No. 11.

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FUSE-WELL No. 14, *Moly*—An Iron Base Rod with alloys added for finer grain structure and greater strength.

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FUSE-WELL No. 22, *Electrode* — Light coated Rod to be used for AC or DC welding in the fabricating and repairing of cast iron castings.

THE CHICAGO HARDWARE FOUNDRY CO.
Weld Rod Division
NORTH CHICAGO, ILLINOIS

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104. RESISTANCE WELDING—The Taylor Winfield Corp. Bulletin SP-8A contains tables simplifying calculations of the electrical power supply required by resistance welders.

105. LEAK DETECTOR—General Electric Co. Bulletin GEA-6827A, 10 pages, discusses the type H-6 halogen leak detector and accessory equipment.

106. GAS REGULATORS—Linde Co. 16-page catalog gives description and illustrates Oxweld industrial gas regulators and portable manifolds.

107. PYROMETER ACCESSORIES—The Bristol Co. Bulletin P1238 is a buyers' guide and users' manual for thermocouples and pyrometer accessories.

108. GAMMA RADIOGRAPHY—Radionics Inc. Catalog sheet gives information and specifications of gamma radiography unit, Model 60-1,000.

109. HYDRAULIC HOSE—Anchor Coupling Co. Inc. Two-color wall chart provides a quick reference to reusable hydraulic hose, couplings and fittings.

110. WELDING ELECTRODES—National Cylinder Gas Div. Chemetron Corp. 20-page illustrated booklet gives complete information on arc welding electrodes, including specifications, chemical requirements and methods of estimating electrode consumption.

111. SENSING ELEMENTS—Norton Co. Bulletin H-3.1 describes methods of mounting temperature and strain measuring elements by means of ceramic spray coatings.

112. METAL WEAR—Rankin Mfg. Co. Data sheet 103 gives facts about metal wear for maintenance men.

113. CARBON DIOXIDE—Pure Carbonic Co. Brochure ADPC 26A covers the characteristics of carbon dioxide Mig welding of mild steel and low alloy steel and lists advantages of CO_2 in welding.

114. PIPE FITTING—Tube Turns Div., Chemetron Corp. 72-page handbook for pipe fitters and weldors provides mathematical, physical, chemical and metallurgical data and related design, layout and mechanical information.

115. ARC WELDMOBILE—Hobart Bros. Co. Four-page data sheet gives thorough information on self-propelled d-c arc Weldmobile.

116. FLAME HARDENING—Air Reduction Sales Co. Brochure (Form ADC 704A) on flame hardening discusses problems of oxyacetylene flame hardening and shows how problems can be solved.

117. PIPE JOINTS—Allied Piping Products Co., Inc. Sheet gives test data on internal burst pressures for fabricated pipe joints.

118. RESISTANCE WELDING—Kirkhof Mfg. Corp. Bulletin describes complete line of Epoxy-Pak resistance welding transformers.

119. PRODUCTION PROBLEMS — Eaton Mfg. Co. Special techniques and processes available to help solve problems in production and development programs are described in booklet entitled "Got a Problem?"

121. PORTABLE X-RAY — Balteau Electric Corp. Two new technical bulletins deal with use of portable X-ray equipment in aircraft maintenance and in storage tank fabrication. A third compares popular non-destructive testing methods.

122. D-C WELDERS — Metal & Thermit Corp. Data sheet describes firm's silicon rectifier d-c welders covering current ranges up to 625 amp. They are models M20R, M30R and M40R.

127. SPRAYING PROCESS—Plasma Bond Div., Thermal Dynamics Corp. Bulletin 75-1 describes the metallic and ceramic coatings applied by plasma spraying technique.

128. MULTI-OPERATOR WELDING—A. O. Smith Co. Brochure MW259 explains and lists advantages of multi-operator welding systems.

129. GAS SHIELDING—Auto Arc-Weld Mfg. Co. leaflet illustrates gas shielding attachments for semi-automatic welder.

130. TEMPERATURE PROBES—Rosemount Engineering Co. Short form catalog lists temperature probes with illustrations.

132. CRYOGENIC PUMP—The Cosmodyne Corp. Technical data sheet gives information on a high-pressure, high-flow cryogenic pump.

141. MIG WELDING—Linde Co. Mechanized Mig welding equipment and operations is subject of 12-page booklet which contains brief discussion of power factors involved.

146. QUICK-BOND CLAMP—Pipetron Co. Data sheet lists features and illustrates quick-bond clamp for arc welding.

147. ALUMINA CERAMICS—Diamonite Products Mfg. Co. Form 1157 gives properties and characteristics of firm's products for welding, brazing and induction heating.

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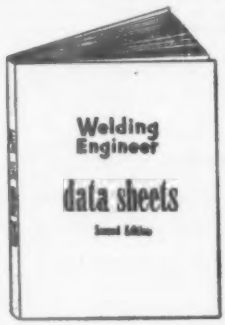

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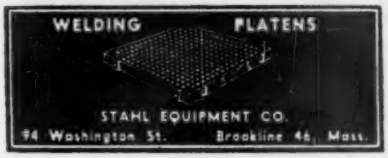

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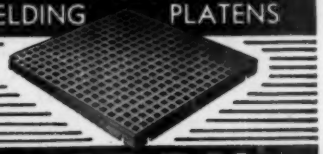

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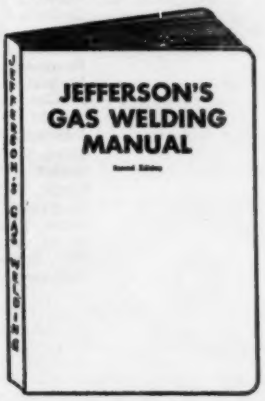

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WELDING ENGINEER, Volume 45

January to December, 1960, inclusive

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158. Alloy Rods Co. — Data sheet on "Atom-Arc" "T" gives detailed application information.

186. All-State Welding Alloys Co., Inc. — Instruction Manual and Aluminum Manual available, to help you select the alloy and flux best suited for each job.

197. Anti-Borax Compound Co., Inc. — Descriptive booklet and sample of the new "Royal" hardening powder is available.

188. Aro Spot Welder Div. — Illustrated Literature on the new model 407 spot welder is available.

177. Bastian Blessing Co. — Catalog GF-300 on "RegO" Adapters & Fittings and other compressed gas control equipment is available.

196. Becker Brothers Carbon Co. — Catalog available on carbon and graphite for welding electrodes, rods and other materials used in welding.

170. The Budd Co. — Gamma Radiography Bulletin available.

201. Columbia Electric Mfg. Co. — Catalog WE-400 available on the Tong-Test Ammeter to get the exact amperage for your welding job.

193. Dockson Corp. — Catalog 56-05 available on Dockson torches and other welding equipment manufactured by Dockson.

199. Eisler Engineering Co., Inc. — Catalog No. 93-57 available on spot and wire butt welders and the vertical type press welder.

181. Electric Arc, Inc. — Write for brochure, "Smith-Dolan System of Low-Frequency Induction Heating."

169. Gevaert Co. of America, Inc. — Write for a Handy Exposure Calculator for either CO 60 or IR 192 Radiography of Steel.

160. Handy & Harman — Bulletin 20 on silver brazing and its benefits available.

152. Hobart Brothers Co. — Bulletin DM-159 further explains the new "Micro-Wire" welding package for position welding.

153. International Nickel Co., Inc. — Booklet available, "Repair Cast Iron Parts Quickly and Easily" further explains the Ni-Rod "55" story.

168. Markal Company — Literature available on "Thermomelt" temperature indicators and sample pellets also available.

187. Merrill Brothers — Catalog C-2 available on the large opening "G" Clamp and other material handling devices manufactured by Merrill.

185. Metal & Thermit Corporation — Data sheet on welders manufactured by M&T available.

200. Metalloy Products Co. — Write for a testing sample of "Galvalloy" for your galvanizing job.

206. Miller Electric Mfg. Co. — Further information on the Miller Gold Star d-c welders will be sent promptly upon request.

161. Page Steel & Wire Div. — Folders DH-402-C and DH-1218 contains information on submerged arc and inert gas automatic welding wire manufactured by Page.

194. Ruemelin Mfg. Co. — Bulletin 37-D describes all models of Ruemelin fume collectors.

182. Tuffaloy, Div. of Air Reduction Sales Co. — Catalog available giving information on Tuffaloy tips, shanks, holders, bar stock accessories and prices.

191. Webb Corp. — Illustrated literature on tank production machinery manufactured by Webb, is available.

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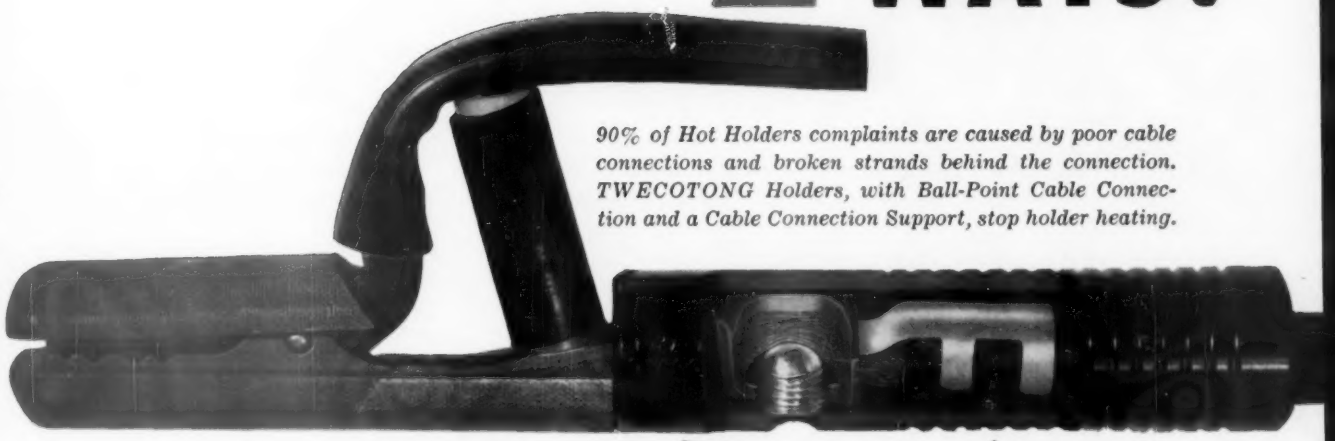
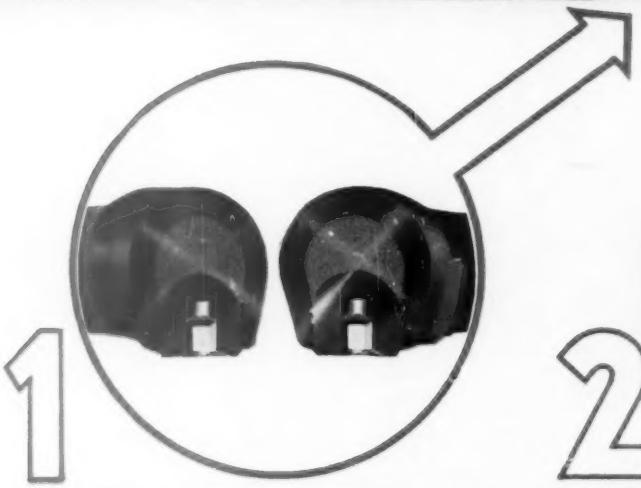
226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250

STOP HOLDER HEATING 2 WAYS!



90% of Hot Holders complaints are caused by poor cable connections and broken strands behind the connection. TWECOTONG Holders, with Ball-Point Cable Connection and a Cable Connection Support, stop holder heating.



TWECO'S Ball-Point Connection

holds every strand under extreme pressure. Each strand carries current. Does not work loose. Holder can be installed on cable in less than two minutes using 7/32" hex wrench. Saves time — Saves money.

TWECO'S Cable Connection Support

absolutely stops the movement of cable strands behind the cable connection. Strands can not break and cause heating. Also stops the cable jacket from slipping, exposing bare strands.

Tweco

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PRODUCTS, INC.

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SR

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SRH

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ELECTRIC MANUFACTURING COMPANY

APPLETON • WISCONSIN

The practical limits of perfection in d-c welding, as such limitations are assessed today, are attained in Miller Gold Star welders with their exclusive, completely sealed, semi-metallic rectifiers. No other welder challenges them seriously in degree of arc stability, weld density, ease in arc starting, rectifier life and quietness of operation.

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The space-saving 30¼" high SRH model is available in 200, 300 or 400 ampere sizes.

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